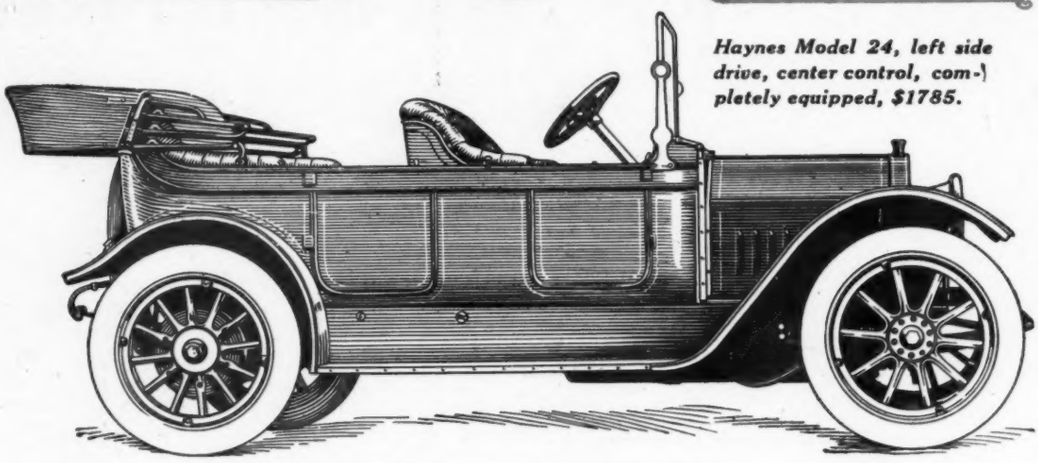
The AUTOMOBILE

NEW YORK, APRIL 10, 1913

In this issue the Maxwell Motor Company publishes an announcement that is fraught with more of interest and concern to Dealers than any similar announcement that has been made in several years past.

PRICE TEN CENTS



Haynes Model 24, left side drive, center control, completely equipped, $1785.

Always a Leader— Now More Than Ever

HAYNES

A New Model at New Low Price

HAYNES Model 24—a big, roomy five-passenger touring car—brings a new standard of value into the $1800 field.

This Haynes for $1785 is a *rare car.*

Keep in mind the fact that here is a *known* make, *not* an unknown or a *new make.* Remember that Haynes history and Haynes success reach clear back to the *very beginning* of American motordom. Remember that in twenty years Haynes has never marketed an experiment or an over-priced car. Take note of these things and you will begin to appreciate the value of this new model.

In the whole $1800 class we do not believe there is any other car that measures up to this new Haynes Model 24, in design, materials, equipment, the sincerity which is built into it.

Model 24 is *big enough* for a good-sized family, so *strong* that it is ideal for touring, so *stylish* as to please really *critical* folk, and *fast enough* for anybody. It is roomy both front and rear. Its power is all you could ask for. And it's so *quiet* we might well call it silent.

An interesting car, mechanically!

Left side drive, center control.

Electrically started and lighted, by the Leece-Neville most efficient separate unit system, the type of equipment first adopted by Haynes and now recognized as the standard type.

Four cylinders, 4¼-inch bore, 5½-inch stroke, cast in pairs. Wheelbase, 118 inches.

34 x 4-inch tires.

Big brakes, 14-in. x 2½-in.

Notable regular equipment, including, besides the electric starting and lighting system, top, top cover, two large electric headlights, glass front, electric side lights flush in dash, electric tail light, electric cowl lamp, Eiseman dual magneto, speedometer, extra demountable rim, horn, coat and foot rails, tire irons, tools, etc.

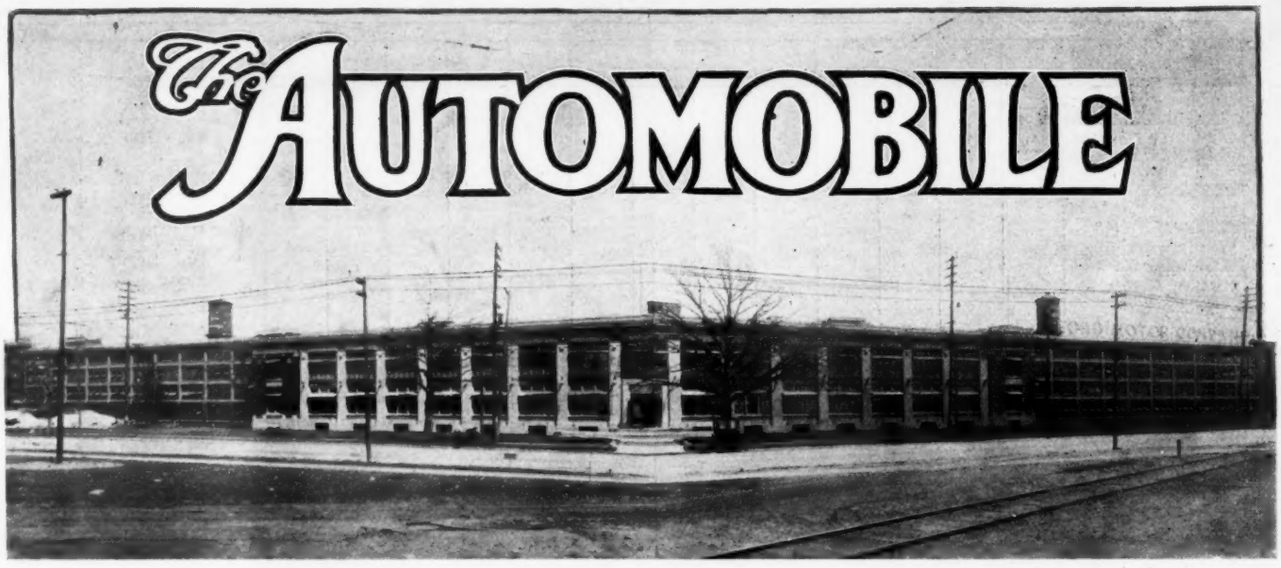
The new Haynes "Six," 4¼ x 5½ motor, 130-inch wheelbase, $2500.

When you are selecting a new line, why not pick a certainty?

HAYNES AUTOMOBILE COMPANY

503 Union Street **Kokomo, Indiana**

VOL. XXVIII NEW YORK—THURSDAY, APRIL 10, 1913—CHICAGO No. 15



Front view of the largest automobile factory in the world. The plant of the Ford Motor Car Co., Detroit, Mich.

Detroit

The City Built by the Automobile Industry

By L. V. Spencer

DETROIT is the world's automobile center. Its machines have been shipped to every port and have penetrated to every nook and corner of the earth where automobiles are permitted to go, spreading the motor car fame of America's "City of the Straits" broadcast.

Whenever the world thinks of the automobile, it thinks of Detroit. If Mr. Dealer in Naples or Hamburg or Vienna is thinking of taking on a line of motor vehicles, he writes Detroit.

With an estimated production this year of nearly 400,000 machines, valued at close to $500,000,000, Detroit enters the fourteenth year of its active automobile history as the heart of the motor vehicle industry, the growth of which is unparalleled in the annals of the industrial world.

In a decade it has overtopped all of the other healthy industries of the city. Just as Pittsburgh centers the steel industry, as Chicago is noted for its great packing houses, as Marseilles is world-famed for its silk industries, so Detroit is the pulse of an industry which 20 years ago was looked upon as a joke.

Though originally possessing no greater advantages than half a dozen other American cities, Detroit today offers greater inducements perhaps than any other community for the location of factories dependent upon the automobile industry. Here are located parts and accessory plants of all descriptions, in addition to the many automobile factories, and the very concentration of all these different phases naturally means a steady increase from year to year. The automobile maker who intends to assemble his product need no worry about freight rates, or delays in transportation for getting his products to his own plant. It is only necessary to transport them from their places of manufacture, perhaps a distance of a few city blocks or a few miles.

Detroit's automobile manufacturing history dates back to about the year 1899, when the industry assumed the form of a commercial enterprise, although Henry Ford, and R. E. Olds, developed horseless carriages which would actually run before that date. The Detroit Board of Commerce records show that in September, 1899, the Olds Motor Works commenced operations in Detroit with a capital of $500,000, which was then sufficient for the company's activities in that city as well as in Lansing.

Meantime, Henry Ford continued to work with his car, experimenting and inventing and later building a small plant in the suburbs. June 27, 1903, his company was incorporated. The present great Ford plant is the largest in the world.

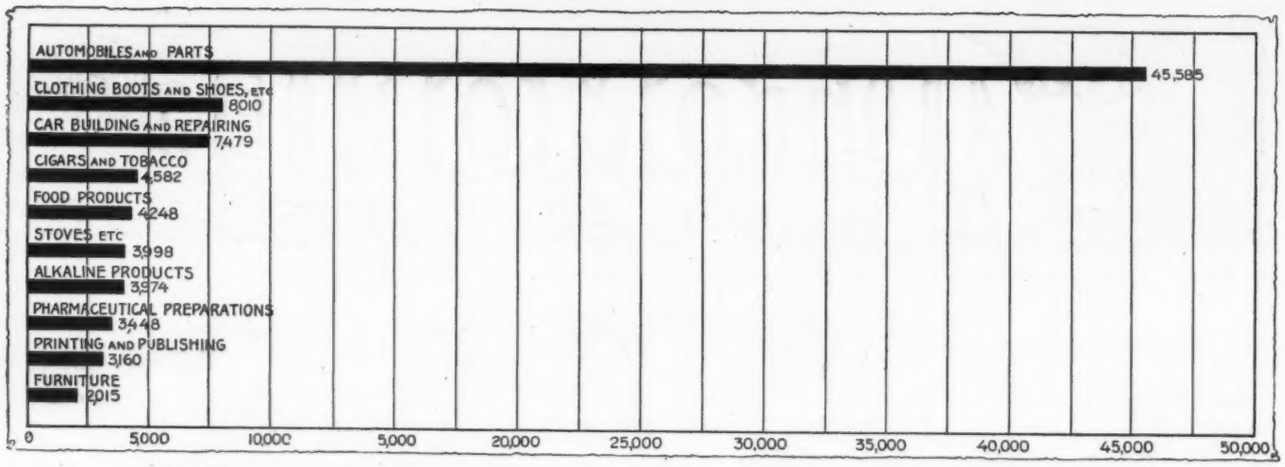
But these early concerns—if they can be called "early" when not yet 15 years old—were soon followed by others.

In 1901 the Cadillac company was launched with a $300,000 capital; and 2 years later, in 1903, the Packard commenced operations with $500,000 capital.

During the year following no fewer than twelve concerns were recorded, and in 1905 ten more took out incorporation papers. None of these twenty-two was ever firmly established and within a few years they were either absorbed by laterly formed companies or were forced to go out of business. Their products were not sufficiently practical to give the public confidence in them and the freak stage had not yet been passed.

In 1909 the Chalmers-Detroit Co., which is now the Chalmers Motor Co., and the De Luxe, since absorbed by the Studebaker Corp., were formed. In 1910 the Regal and the Brush were born. The latter has recently been absorbed by the newly-formed Maxwell Motor Co.

The Detroit automobile industry plans to manufacture cars to a value this year which will exceed the total assessed valuation of the City of Detroit for 1912. The estimated value of the production of cars reaches the stupendous figure of $462,180,000,



Employees of some of Detroit's leading industries in 1911 as compiled by the State Labor Commissioner

while the total assessed city valuation for the fiscal year 1912 to 1913 amounts to $456,816,100.

The accompanying table showing Detroit's annual production of cars from 1905 to the present is of particular interest.

During those 9 years the increase has been almost unbelievable to the average person, but to the Detroiter it is looked upon as the natural course of events. **Any one of a dozen single factories today is manufacturing more complete machines than the entire city industry produced during 1905.**

But the product has practically doubled within the last year, more machines being built here alone than were produced in the rest of the country in 1912, according to the factories' own statements, which bid fair to be lived up to in nearly every case. These figures for the present year are composed largely of passenger cars, although the other classes are fairly well represented:

	1912	1913
Gasoline pleasure cars	185,560	367,450
Gasoline commercials	4,310	12,875
Electric pleasure cars	1,870	3,675
Electric commercials	510	1,150
Totals	192,250	385,150

One big factor in this great passenger car showing is the tremendous production of the Ford plant, which will this year turn out 200,000 complete machines on a schedule soon to be raised to 1,000 cars per day, yet, all classes of vehicles reveal a largely increased production over 1912, the commercial class showing the greatest gain of any and putting the city unmistakably in the lead in the production of business cars, as well as passenger types, as the following percentages will bring out:

	Per cent.
Gasoline commercial car increase over 1912	198.6
Electric commercial car increase over 1912	125.0
Gasoline pleasure car increase over 1912	98.3
Electric pleasure car increase over 1912	96.6

Yet it should not be considered that Detroit has no lines of activity save those connected with the making of motor vehicles. Bearing on this phase of the question the accompanying table, showing the value of Michigan's products as compared with the same lines of endeavor for Detroit alone are of interest.

The automobile industry leads by a comfortable margin, as shown by the census reports, but it is not Detroit's only means of salvation. Brass and bronze products, foundry and machine shop products, tobacco manufactures and so on total high in the millions, and in their respective lines have more than put Detroit "on the map."

In its thirty-three automobile factories now operating, Detroit employs 48,450 wage earners, as compared with 30,863 for 1911.

These figures are exclusive of the parts and accessory manufacturing plants. The increase in number of men so employed has grown in 9 years from 2,000 to near the 50,000 mark.

On paper this great army of wage earners does not seem nearly so large as it actually is. When it is considered that there are more men in Detroit employed in making automobiles alone than the entire population of such cities as Allentown, Pa., Berkeley, Cal., Davenport, Iowa, Macon, Ga., and Cambridge, England, the significance of industrial Detroit is perhaps better brought home to the average person. The figures extending over 9 years are given below:

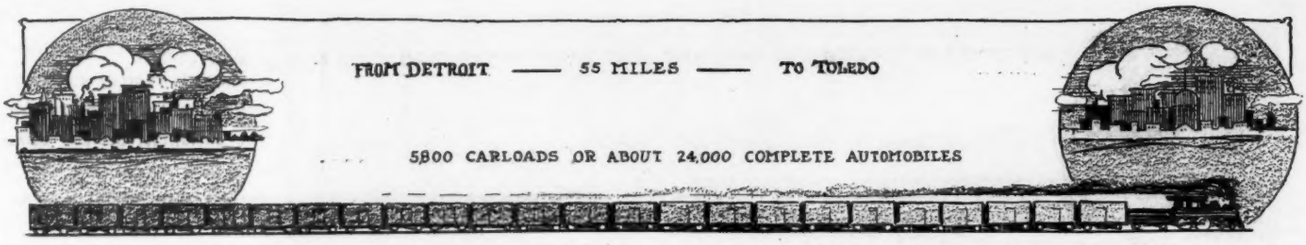
1904		2,034
1905		4,500
1906	(estimate)	6,000
1907	(estimate)	7,600
1908		8,430
1909		16,000
1910		27,200
1911		30,863
1912		48,450

Adding to the great number in the automobile plants, the many thousands employed in the accessory and parts making concerns, the 1913 daily average total reaches 72,675 as against 45,585 for 1911.

The number of automobile, automobile parts and accessory plants in 1911 reached ninety-four, while at the present time the industry concentrated in Detroit is inclusive of 158 plants making exclusively automobiles or products pertaining to them. Of course, if the many concerns making such parts as screws, nuts and bolts, which are used in the motor car but which nevertheless are demanded in other constructions as well, are in-

AUTOMOBILE MEN GOOD WAGES STEADY EMPLOYMENT IN DETROIT
Sheet metal workers, fender finishers, A-1 bench die sinkers, Potter & Johnson operators, bearing scrapers, drill press hands (married men preferred), Warner & Swasey operators and Landis grinders (internal and external).
POSITIONS OPEN
Cleveland Auto-Oprs., Jones & Lamson oprs., monitor hands, screw mach. and lathe hands, planer hands, bench assemblers, polishers and buffers, boat carpenters, and heaters and helpers for large shop.
AMERICANS ONLY.
MIDDLE-AGED MARRIED MEN EQUIPPED WITH TOOLS GIVEN PREFERENCE
EMPLOYMENT OFFICE OPEN ALL DAY.
POSITIONS OPEN
FOR THE FOLLOWING CLASS OF HELP. A-1 MOTOR ASSEMBLERS, REPAIR MEN, BEARING SCRAPERS, INTERNAL AND EXTERNAL GRINDERS. ALSO MILLING MACHINE DRILL PRESS AND BULLARD OPERATORS AND ONE FIRST CLASS SAND BLAST OPERATOR. MARRIED MEN PREFERRED. STEADY EMPLOYMENT. HIGHEST WAGES. ALL APPLICATIONS ANSWERED. ADDRESS, BOX J, NO.
AUTO MECHANICS. 40 PLACED TUESDAY. NEED 170 MORE. COMMONWEALTH,

There is a constant demand for automobile workers in Detroit. The above are typical advertisements



The carload shipments of automobiles from Detroit during February, if made into a single train would reach from that city to Toledo, O.

cluded, the total number of plants would be still further increased.

Since 1910 the automobile factories of Detroit have undergone numerous changes and many of the names once well known are no longer in the automobile roster.

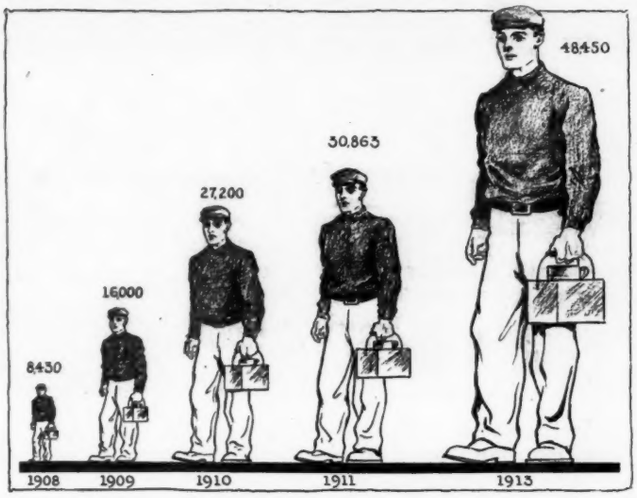
In 1911 there were 2,126 factories in the city and at the present time this has increased to 2,450. The total employed male wage earners in the city during 1911 was 97,056, while in 1913 the number approximates 110,000.

With these figures before us, the exact status of Detroit's leading industry is easily determined. Let us consider the following tabulation, which summarizes the factory figures just given:

	1911	1913
Wage earners in all automobile parts and accessory plants	45,585	72,675
Number of automobile, parts and accessory plants	94	158
Proportion of motor car industry wage earners to total Detroit population	8.4%	12.8%
Total number of factories	2,126	2,450
Total wage earners in all factories	97,056	110,000
Proportion of automobile parts and accessory plants to total number of factories in the city	4.42%	6.45%
Proportion of wage earners in automobile industry to total wage earners of the city	50%	66%

It will be seen that the proportion of motor car wage earners to Detroit's total population during 1911 was only 8.4 per cent., while in 1913 it has increased to 12.8 per cent., an increase of 4.4 per cent., which is a remarkable gain for a single industry in 2 years.

Comparing the city's wage earners as a whole with those affiliated with the automobile industry, we find that 1911 showed 50 per cent. of the total number of wage earners to be in the automobile class. This year the increase has been 16 per cent. But comparison of the total number of automobile and parts and accessory plants with the aggregate number of factories in the city shows the very small percentage of 4.42 in 1911, while at the present time only 6.45 per cent. of the total number of establishments are in the automobile class. Thus, although the number of factories is small in comparison with the whole, each one of these employs a large number of men and brings the total motor industry wage earners to the head of the list following:



The number of wage earners in Detroit automobile factories (exclusive of parts and accessory makers) has increased six-fold in the last 5 years. The above illustration graphically depicts the phenomenal increase which marked each succeeding year

Automobiles and parts	45,585
Clothing, boots and shoes, etc.	8,010
Car building and repairing	7,479
Cigars and tobacco	4,582
Food products	4,248
Stoves, heating apparatus	3,998
Soda ash, alkaline products	3,974
Pharmaceutical preparations	3,448

This table, which shows several of Detroit's leading industries, reveals the fact that each of a half dozen motor car factories employs more men than do some of the other complete industries of the city. The clothing and boots and shoes contingent does not reach the number in the Ford factory alone by some 6,000 men, while the number employed in either the Packard shops, in the Cadillac, or in the Studebaker plants, is in excess of the entire cigars and tobacco following. Yet Detroit is regarded as the "Tampa of the North," so far as the manufacture of smoking materials is concerned, as may be seen by the high standing of that industry in the table given above.

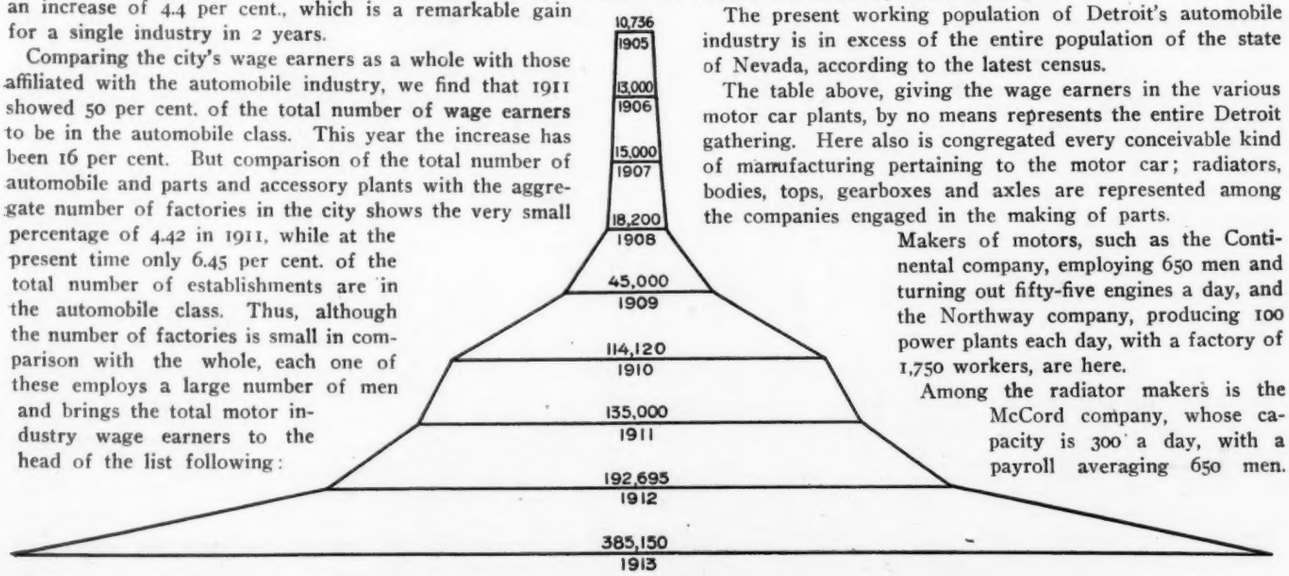
A table showing the number of wage earners in each of the city's automobile plants in 1911 and at the present time is given below. It reveals to the skeptical the difficulty of Detroit's municipal problem of housing thousands of working men close to their places of occupation, which are spread over the entire city and mostly in the outlying districts. No one section may be regarded as the automobile center of the city, for many of the factories are from 4 to 10 miles apart.

The present working population of Detroit's automobile industry is in excess of the entire population of the state of Nevada, according to the latest census.

The table above, giving the wage earners in the various motor car plants, by no means represents the entire Detroit gathering. Here also is congregated every conceivable kind of manufacturing pertaining to the motor car; radiators, bodies, tops, gearboxes and axles are represented among the companies engaged in the making of parts.

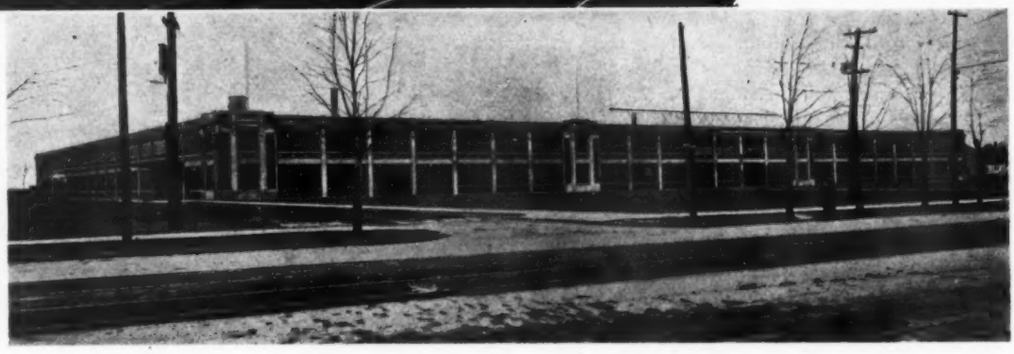
Makers of motors, such as the Continental company, employing 650 men and turning out fifty-five engines a day, and the Northway company, producing 100 power plants each day, with a factory of 1,750 workers, are here.

Among the radiator makers is the McCord company, whose capacity is 300 a day, with a payroll averaging 650 men.



The ever-expanding funnel of Detroit's automobile production, showing the increase from year to year

Three examples of modern automobile factory construction to be seen in Detroit. The buildings, besides being large and spread out over a considerable area, are designed to afford plenty of light and air for the workmen



Among the axle contingent is the Timken company, producing 125,000 axles a year and employing 150 men. It is said to be the largest axle factory in the world, having 250,000 square feet of floor-space.

Looking further, we find the Hayes Mfg. Co., retaining 1,100 workers and producing 15,000 to 20,000 automobile bodies a year; the Jeffery-DeWitt company, with its 140 men, turns out 1,500,000 complete spark-plugs a year. It produces 14,000 porcelains each week.

The Holley Bros. company will this year produce 250,000 carbureters on a daily schedule of 1,000 instruments, with an average payroll of 250 men.

Then there is the Disco company, which will turn out 30,000 electric starting devices this year, and which employs 100 men, and the Hyatt Roller Bearing Co., with a force of 1,000 men, turning out over 2,000,000 of its type of bearings.

While the parts and accessory makers are not all on this enormous scale, they are all thriving and each is adding to Detroit's ever increasing production. This year these plants are 125 strong.

With this great production the Detroit industry is face to face with a serious problem—that of securing sufficient automobile freight cars for the transportation of its many machines. Indeed, the freight car situation has been considered of so serious a nature that the Traffic Bureau of the National Association of Automobile Manufacturers has seen fit to open an office in Detroit, in order to better cope with the problem at first hand. Likewise, the Detroit Chamber of Commerce has a similar bureau for the aiding of shippers.

During January, 5,000 carloads of automobiles left the city, while during February this number was increased to 5,800. Before the season is well advanced these figures will be much larger. Each freight car carries from one to eight machines, depending on the size. Considering all makes shipped, it seems probable that the average number of automobiles per freight car runs about four, hence the shipments of machines for the first 2 months of the year have reached the enormous total of about 43,200. February's carloads, if arranged in a single train would have a length of approximately 55 miles, equal to the distance from Detroit to Toledo.

Obviously, with such enormous outgoings of freight cars, it is a very serious matter to insure the return of all of these when empty. Shippers of other classes of goods can make use of the automobile cars as well as they can any other type of box car, while the automobile maker must necessarily use only specially constructed cars which will admit machines through the doors. This handicap has been greatly felt within the last year or so.

But Detroit realizes the need for protecting its automobile factories so far as it is in its power, and through the good offices of the Associated Traffic Bureau and the Traffic Departments of the Board of Commerce it is coping with the situation as best it can.

Last year, Detroit makers were forced to resort to a number of schemes for storing their cars pending shipment. It would have meant many thousands of dollars to have held up the production of cars during the busy season and hence the manufacturers went merrily on while shipping was many times practically at a standstill. Motor cars were stored wherever space was available, the Cadillac company, as a case in point, having sometimes as many as fifty completed automobiles outside its warehouse at one time. Other plants resorted to the use of temporary shelters, such as sheds and tents.

It is probable that this year will see many like instances, although the factories have nearly all increased their floor-space in order to take care of such emergencies.

Table Showing Detroit's Annual Production of Cars and Valuation of Same, Based on Average List Price

Year	Cars Built	Value
1905	10,736	$12,883,200
1906	13,000	15,600,000
1907	15,000	18,000,000
1908	18,200	22,600,000
1909	45,000	54,300,000
1910	114,120	134,587,000
1911	135,000	162,000,000
1912	192,695	231,234,000
1913	385,150	462,180,000

The makers realize the importance of making every freight car count, for at the present time a real famine in rolling stock is predicted for April and May here.

The Studebaker Corporation has just made an investment of over $60,000 for facilities for thus loading its machines. The switch tracks back of its plants are 20 feet above the level of the factory yard and the new loading platform is merely a massive shelf, two city blocks long, with elevators.

Another aspect of Detroit's great position in the industry is brought out by its exports which, though going to all parts of the world, are principally to Canada, England, South Africa and New Zealand. During January and February of this year, Canada bought 267 Detroit cars, valued at $387,231; England purchased 122; South Africa 80, and New Zealand, 30. The table shows the principal exports for the first 2 months of the year:

	No.	Value
Canada	267	$387,231
England	122	134,353
South Africa	80	105,096
New Zealand	30	34,804

Yet, it is not all motor cars which find markets abroad, for the Detroit parts and accessory makers also do a good business with the foreigners; nor is the passenger car alone exported, commercial vehicles having a fairly good sale so far this year. During January and February, passenger cars valued at over $500,000 were sent abroad, while next comes the miscellaneous parts, which aggregated $385,000. The table follows:

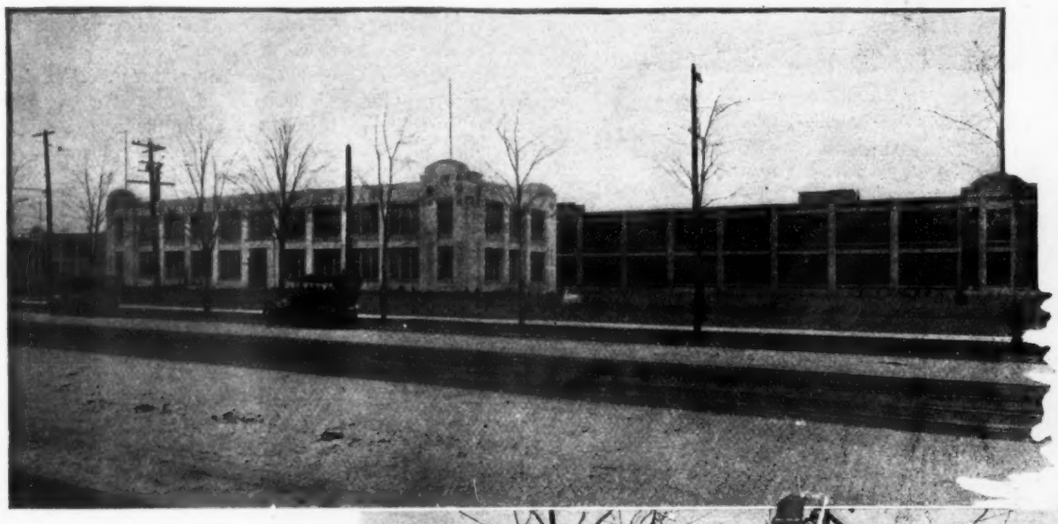
	No.	Value
Commercial cars	38	$37,979
Passenger cars	522	652,486
Tires	...	22,859
Engines	1,085	96,334
Other parts	...	385,385
Total value		$1,195,043

Figures Showing the Value of Michigan's Principal Products, as Compared with Detroit Alone. The Automobile Industry Leads. These Figures Are from the Last Census Reports

	Detroit	Rest of the State
Automobiles and their parts	$59,356,000	$37,115,000
Boots and shoes	2,744,000	2,512,000
Brass and bronze products	12,297,000	1,593,000
Canning and preserving	1,568,000	3,403,000
Confectionery	1,136,000	1,808,000
Copper, tin and sheet iron products	3,534,000	1,395,000
Electrical machinery	1,148,000	1,179,000
Foundry and machine shop products	18,296,000	27,103,000
Fur goods	1,738,000	546,000
Iron and steel, steel works and rolling mills	2,297,000	373,000
Leather goods	1,396,000	1,164,000
Liquors, malt	4,942,000	4,898,000
Patent medicines and druggist preparations	11,558,000	1,917,000
Printing and publishing	7,291,000	10,057,000
Slaughtering and meat packing	12,850,000	565,000
Stoves and furnaces	5,676,000	4,547,000
Tobacco manufacturers	12,773,000	3,406,000

With these figures as a basis for estimate for the entire year, 1913 looks to be a record breaker for export business and it should reach $30,000,000 for the value of Detroit-made automobiles alone. From a total of $82,000 worth of machines during 1903, in 10 years Detroit has succeeded in convincing the world of the merit of its machines, yearly increasing its exports at a tremendous rate. This is forcibly brought out below:

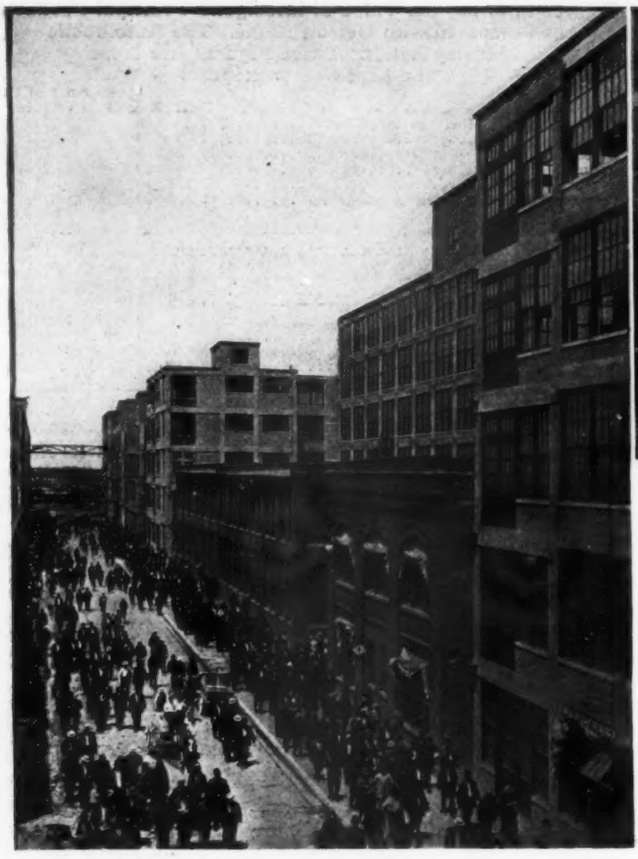
1903	$82,933
1904	162,529
1905	255,597
1906	269,554
1907	422,101
1908	399,010
1909	699,706
1910	2,106,615
1911	3,864,994
1912 (estimated)	19,500,000
1913 (estimated)	30,000,000



Two more examples of the type of buildings erected and occupied by the automobile manufacturing companies of Detroit. The illustrations furnish a very good idea of the magnitude of the plants, which turn out more automobiles than all the factories of Europe combined

The present average value of the exported car is, for the commercial class $1,000, and for the passenger type, $1,250, showing that our market abroad is for just the type of medium-priced vehicle on which Detroit's fame is largely based.

Last year the foreign market for American cars reached the stupendous figure of $30,000,000 and of this amount about 65 per



An avenue at the Packard factory during the noon hour. Here 6,700 men are employed to build 4,500 automobiles and trucks

Double-decking shipments by the Studebaker loading crews

cent. was paid to makers of Detroit, proving that cars made here have withstood the test of foreign roads and foreign conditions.

An interesting feature of the financial side of Detroit's invasion of the foreign low-priced car market is furnished by the Commercial Manager of the First National Bank of Detroit. "The first question of the shipper entering the foreign export trade," he says, "will be invariably, 'How am I to be paid for my goods?' "

"If the foreign buyer has remitted the cost of the car when placing his order the procedure is the same as for home sales, as all he has to do is to ship the car consigning it to the buyer. If, however, the cars are to be paid for on arrival, the service of

Noontime at the Ford factory, which is working on a schedule of nearly 1,000 cars a day. There are over 14,000 men on the payroll

a bank having its own correspondents abroad is required and it is a part of that bank's function to collect the drafts made against these shipments. Such drafts supported by the necessary shipping documents may be discounted by the bank as are domestic drafts.

"In other cases, the buyer abroad arranges for a bank credit which authorizes the Detroit shipper to draw under specified terms a draft with shipping documents attached for the exact invoice amount in a foreign currency. Such drafts are readily salable and can be bought by the bank operating a foreign department so that the shipper receives the exact invoice amount for his goods on the day they leave his factory.

"These credits are generally established in pounds sterling and have become quite popular with Detroit shippers. An exporter operating under such credit is relieved from the responsibility ordinarily attached to his direct drafts upon the consignee, so that an arrangement of this kind is a most desirable one."

A review of Detroit's position in the industry would be incomplete without a few references to the greatest of all the world's automobile factories, the Ford plant. It is difficult for the average person outside of Detroit to realize that this single factory will manufacture this year 200,000 complete machines, yet it is a fact, the minimum schedule calling for 150,000 cars with a reserve of 50,000, which from all indications now will all be needed to supply the demand.

WAGE EARNERS IN DETROIT AUTOMOBILE FACTORIES

Abbott	430	450
Anderson	390	600
Briggs-Detroiter	....	250
Brush	720	(See Note A)
Cadillac	5,400	6,000
Chalmers	2,350	2,700
Chevrolet	24	275
Commerce	....	35
Federal	60	100
Flanders (Everitt-Metzger)	806	(See Note A)
Ford	3,500	14,500
Grabowsky	325	....
Herreshoff	40	110
Hudson	675	1,150
Hupp	600	3,000
Keeton	....	200
King	40	125
Krit	340	275
Lozier	640	900
Maxwell	....	(See Note A)
Packard	6,200	6,700
Paige	100	350
Poss	20	....
R-C-H	600	520
Regal	350	600
Sampson (Alden) Co.	450	(See Note A)
Studebaker (EMF)	6,350	7,900
Warren	200	225
Add for unnamed, etc.	253	1,385
	30,863	48,450

Note A—The Flanders, Brush and Sampson plants, which are subsidiaries of the Maxwell Motor Co., are now operating, but we are not at liberty to give their present number of employees. The total of the Maxwell wage earners in Detroit, however, is included in the miscellaneous figure at the bottom of the list.

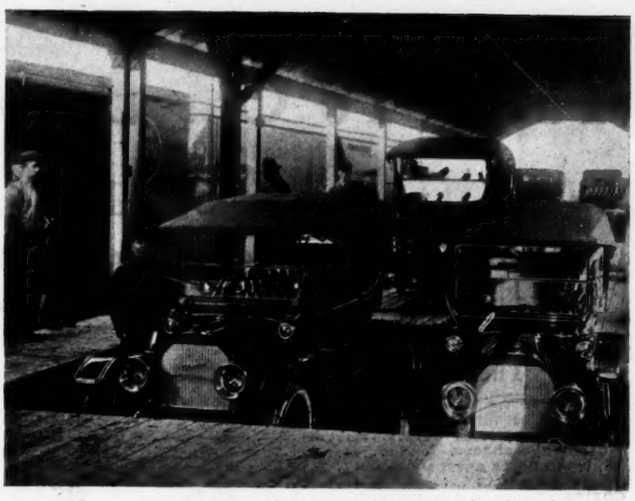
And yet, the Ford plant, though many times larger than any of its neighbors, is only one of the thirty-three within the boundaries of the city.

No one will dispute the great influence which the mammoth industry has had on the city's growth. Its population in 10 years has increased nearly 150,000 and its building has gradually risen until it is today among the leaders in total annual building cost figures. The table below, showing building statistics for sixteen cities during the last year, serves to indicate Detroit's position. It has surpassed St. Louis, Cleveland, Washington, Kansas City, Pittsburgh, Buffalo and many other cities of its size.

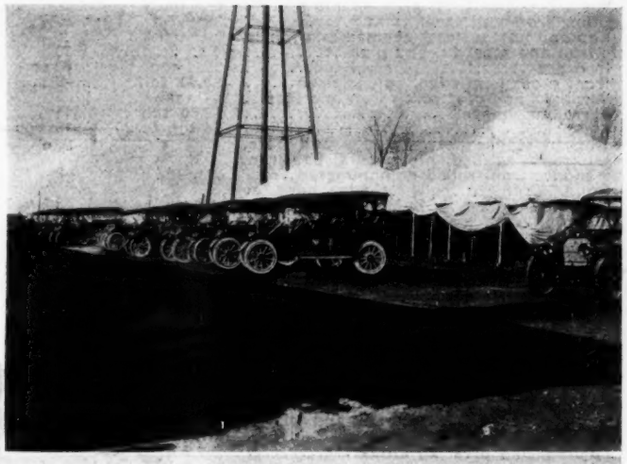
San Francisco	$20,915,000
Boston	19,287,000
DETROIT	19,014,000
St. Louis	18,613,000
Cleveland	16,994,000
Washington	16,562,000
Minneapolis	13,735,000
Kansas City	13,274,000
Milwaukee	12,465,000
Pittsburgh	12,300,000
Cincinnati	11,808,000
Buffalo	10,335,000
Baltimore	8,991,000
St. Paul	8,915,000
Denver	6,086,000
New Orleans	3,157,000

It has been said in some quarters that Detroit's banks are too intimately related to its automobile industry and that should the industry fail, it would carry with it many millions of dollars in the banks. Surprising as it may seem, the average Detroit bank carries only about 25 per cent. of business chargeable to the automobile industry, directly or indirectly. The city's many lines of activity contribute greatly to its resources and it is incorrect to believe that a municipality which today ranks ninth in banking activities, having grown from a position near the bottom of the list, would be so tied up with any one line of activity that a general failure of that line would carry with it all the financial intesets of that city. Still, the automobile industry has done more toward the rise of the city than any other.

Detroit has risen to its present position on a firm foundation and is here to stay. It has come to be one of the great industrial communities of America and is destined for a greater future. Conservative estimates give it a population of 1,000,000 in 1925, and, granting a proportionate growth in other respects, the city's future has no black cloud to mar its bright prospects.



The Studebaker shipping organization, like that of nearly every other Detroit automobile plant, cultivates efficiency. The illustration shows an hydraulic elevator lifting cars from the factory yard to the loading level. Car can be brought to the platform regardless of the position of trains on the sidings. The shipping equipment of the company represents an investment of $60,000. The switch tracks back of the plants are 20 feet above the level of the factory and the new loading platform is a massive shelf as long as two city blocks, with railroad sidings



Upper right—Hudson cars stored in tents owing to lack of storage space. Bottom—Cadillac cars parked in front of the company's warehouse for the same reason

Tariff To Cut Duty on Chassis and Parts

Wilson-Underwood Schedule Proposes Reduction of 15 Per Cent. on Chassis and 25 Per Cent. on Finished Parts—Duty on Complete Cars To Remain 45 Per Cent.

The Old and the New Schedules

Article	Payne	Underwood
Automobiles, finished	45%	45%
Automobile bodies	45%	45%
Automobile chassis	45%	30%
Finished parts except tires	45%	20%
Axles and parts	¾c. lb.	10%
Chains	3c. lb.	24%
Cylindrical tanks	30%	20%
Flexible tubing	30%	20%
Bolts, blanks, nuts, washers	1⅛c. lb.	15%
Spiral nut locks and washers	¾c. lb.	35%
Files and file blanks, rasps	25-77c. doz.	25%
Rivets*	45%	20%
Bearings and parts	45%	35%
Rough forgings, iron and steel	30%	15%
Machined tools	30%	5%
Misc. articles, Fe, Cu, Ni, Zn, Al or other metals, n. spec	45%	25%
Tar-oil spreader for roads	30%	Free
Nails	.4 to ¾c. lb.	Free
Welded tubes, from corr. or plate	2c. lb.	20%
Other iron and steel tubing	30%	20%
Lap and butt welded, seamed and joined iron and steel tu. and pipe	1 to 2c. lb.	20%
Iron ore	15c. ton	Free
Iron, pigs, kentledge, spiegeleisen	$2.50 ton	8%
Wrought and cast scrap iron and steel	$1 ton**	8%
Ferromanganese	$2.50 ton	15%
Ferrosilicon	$5 ton to 20%	15%
Iron in stages between pigs and bars, except castings, muck bars, bar iron, square iron, rolled or hammered	.3c. lb.	8%
Round iron in coils, roads, bars or shaped, rolled or hammered	.6c. lb.	8%
Hoop or band iron and steel, mfd	.3c. lb.	Free
Iron and steel plates and sheets	1.2c. lb.	20%
Steel ingots and similar shapes	7-40c. lb. to 20%	10%
Iron or steel-made abrasives	1c. lb.	30%
Steel and wire rods	.6c. lb.	10%
Cast iron pipe	.25c. lb.	2%
Iron castings, advanced but not finished	.2c. lb. plus .7c. lb.	10%
Malleable castings	.7c. lb.	10%
Lead-bearing ores of all kinds	1.5c. lb. on lead in it	.5c. lb. on lead in ore
Lead dross, lead bullion, base bullion, old refuse run into bars and blocks fit only for remaking	2.125c. lb.	25%
Zinc-bearing ores, all kinds	Free if less than 10% Zn.; if more, .25 to 1c. per lb. zinc	10%
Zinc metal	1.625c. lb.	10%
Zinc in sheets	1.75c. lb.	10%
Zinc, old and worn out	1c. lb.	10%
Aluminum	7c. to 3c. lb. plus 25%	25%
Castor oil	35c. gal.	15c. gal.
Litharge	2.5c. lb.	25%
Zinc, white, oxide	1c. lb.	10%
Paints, colors, pigments	30%	15%
Pumice	.25c. lb.	5%
Mica, trimmed only	5c. lb. plus 20%	30%
Mica and mica products	10c. lb. plus 20%	30%
Electrodes, brushes	30%	25%
Grindstones	$1.75 ton	$1.50 ton
Guttapercha, India rubber and products	35%	10%

*Includes rivets for studding tires.
**Includes only material ready for re-manufacturing.

WASHINGTON, D. C., April 8—Under the new Wilson-Underwood tariff bill introduced today many reductions are made in automobiles and automobile parts, as well as in raw materials that go into the makeup of cars. On chassis imported the present duty of 45 per cent. *ad valorem* is cut to 30 per cent. but complete cars made up of chassis and body remain at the 45 per cent. mark.

On finished parts going into the makeup of a car the reduction is still greater, being from 45 per cent. to 20 per cent.

On ball and roller bearings the tariff is cut from 45 to 25 per cent., almost as much as on finished parts.

Other reductions include axles and parts, chains, rough forgings, malleable castings, steel ingots, iron in stages between ingots and bars, iron ore, welded tubes, flexible tubing, cylindrical tanks, and a score or more of other articles as enumerated in the schedule herewith in which the tariff under the new Underwood proposed plan is in one column and the present tariff under the Payne schedule in the other.

What the attitude of the American car and parts makers will be to the proposed reductions cannot be stated at this time but if telegraphic expressions can be taken as a criterion, the present outlook is not considered seriously. Henry B. Joy, president of the Packard company and chairman of the Tariff Committee of the National Association of Automobile Manufacturers, expresses himself as follows on the new schedule:

"It is impossible in so short a time for me to formulate any serious and intelligent opinion as to the effect of the new Wilson tariff bill in detail. Any person must know that when the fence is taken down the cattle and hogs will get into the corn field. Just so the greater imports will take place under reduced tariffs in very many lines of industry. How serious this will be time can only prove. It is a self-evident principle that when materials are purchased from abroad American employment and production in those articles is to that extent so much curtailed."

Col. Charles Clifton, member of the tariff committee, has expressed himself by saying: "Too early to give anything definite regarding the working of proposed tariff, I am satisfied, however, that the American automobile industry is here to stay."

James Couzens of the Ford company, says: "Do not believe reduction in tariff on automobiles or any of the parts entering therein will materially, if at all, affect the industry. At present details are too limited to speak accurately, but on the surface we have no opposition to make to any of the new schedules."

R. D. Chapin, of the Hudson company, expresses himself to the effect that: "From the information so far at hand I can see no detrimental effect to the automobile industry in the proposed tariff reduction."

Detroit Makers Show Little Concern

DETROIT, MICH., April 8—*Special Telegram*—There appears to be very little concern among the Detroit manufacturers of automobiles as to the contemplated reduction of import duties on automobiles and other products used by the motor car industry. While it is yet quite early for any of the heads of the industry here to formulate any conclusive opinions as to the effects of the new Wilson tariff bill, it is the consensus of opinion of the half dozen prominent makers interviewed today that the proposed reductions would make little or no difference to the industry as a whole.

Imported products used today in automobiles are less than 1 per cent. as compared with those obtained from domestic sources. The greatest percentage of parts imported are ball bearings, which probably amount to from a half to two-thirds of the number used in American cars.

The makers in this country are very much better equipped to make moderate priced and cheap cars than are the Europeans and hence very material tariff reductions would have little or no effect in this direction. However, this would not hold true in other industries, which are not so well equipped for cheap production, such as woolen goods manufacturers, and so on. The reductions will have no appreciable effect upon car cost, although raw metals, such as aluminum, nickel, antimony, lead

and so forth would be imported at slightly less cost than under the present tariff schedules. However, the importations of these products by automobile manufacturers are in the minority as compared with those obtained here at home.

Opinions of Other Makers and Importers

A. L. Riker, of the Locomobile company takes a slightly different view of the proposed tariff, and states: "I greatly fear that if this bill reducing the duty on chassis from 45 to 30 per cent. and on finished parts from 45 to 20 per cent. goes through, it will have a disastrous effect on the American automobile industry, for it will permit foreign chassis to be imported at a lower cost than the American manufacturer can produce them; and as proof of this, the American manufacturers have submitted statistics to the Senate Finance Committee showing that if the duty were so reduced it would be difficult for the American market to compete with the European market."

The views of importers of complete cars are best expressed in the brief which they presented before the Ways and Means Committee some months ago, asking for reductions on chassis and parts. The present reduction in tariff would mean considerable to the purchaser of an imported car. In some cases it would amount to one-half of the difference between 45 per cent. and 30 per cent., in other words, 7.5 per cent. ad valorem.

Mr. Hoey, of the Benz interests, says: "That reducing the duty on a chassis from 45 to 30 per cent. would cause a material reduction of prices. A 36-horsepower model now costing $5,600 would probably be reduced to $5,000. Similarly with commercial motor vehicles, a truck listing at $6,000 would probably be reduced to $5,300 and other trucks, chassis, selling at $5,250, could be cut to $4,500."

Henry N. Allen of the Metallurgique interests, is authority for the statement that: "With the present practice of importing complete cars from France, the prices on his cars would not be influenced. There is a possibility of a French body builder opening a factory in this country, which would permit the chassis to be imported and bodies built in this country under which arrangement there could be a reduction of $500 in the selling price of a $6,500 car."

The attitude of the importer of foreign automobiles is expressed in the brief submitted by E. Lascaris on behalf of the Automobile Importers' Alliance at the hearing on January 10, before the Committee of Ways and Means. In this brief it was suggested that the duty of 45 per cent. on finished automobiles was prohibitive and no longer necessary. This view was supported by the fact that whereas 781 cars were imported up to December 1, 21,700 cars were exported.

In the importers' brief, protest was made against the classification of the automobile as a luxury. The product of the fourth largest industry of the country is used as a matter of necessity by doctors, farmers' and the world at large.

The importers were of the opinion that a duty of 25 per cent. would be more fair to all concerned than the present 45 per cent. At the suggested rate the importers pledge themselves to import 3,000 cars at an approximate value of $6,810,000. On this amount the duties would be $1,702,500. At the present rate of duty the value of the parts imported is 15 per cent. of the value of the total import but with the reduction asked the increase in parts imported would raise the revenue from parts alone $255,000.

As far as reduction in price to the consumer is concerned, if the Underwood schedule went into effect, Mr. Lascaris stated in his brief that the average price for the year of 1912 of the foreign car is $2,275, and the average price of the exported American article $1,000. The average selling price of the foreign vehicle in America is $4,500. The average selling price of the American vehicle is $3,000. The difference represents the duty and freight, 50 per cent.

Views of the Parts and Accessory Makers

To the importers of ball and roller bearings the proposed cut in tariff from 45 to 35 per cent. is disappointing as they had requested a reduction to 25 per cent. or possibly 20. The importation of ball bearings for use in motor cars is an important item, and the briefs filed before the Committee of Ways and Means at Washington show that approximately 75 per cent. of the ball bearings used in American cars are imported, but 25 per cent. being of home manufacture. The brief further states that approximately 80 per cent. of the ball bearings manufactured in Germany are exported to America. The figures show that during 1912 anti-friction bearings were imported to the gross value of $1,508,939 which, on the 45 per cent. schedule paid a duty of $679,022.55. To this sum freight to the extent of $75,446.95 has to be added, giving a grand total for the year of $2,263,408.50, as the gross value of foreign ball bearings included duty and freight when landed here.

This brief further shows the steady increase which has been made in the importation of anti-friction bearings within the last few years. The figures for custom receipts are: 1908, $57,000; 1909, $193,000; 1910, $597,000; 1911 $487,000; 1912, $679,022.55.

The brief presented by the ball bearing importers further states: "Steel balls and ball bearings are imported from Germany Italy, France, Sweden, Switzerland, and England, and if the tariff on steel balls and ball bearings is reduced to 25 cents, it is evident that competition will compel the importers of these goods to give the benefit of this reduction to the user."

The representatives of American bearings in their petitions to the Ways and Means Committee stated that: "American labor costs two to two and one-half times that of foreign labor in this branch of the metal industry, and further the foreign product comes into fair competition with us, and that only 2 1-2 per cent. of this product is represented in the cost of an automobile, hence there is no reason for disturbing the present duty of 45 per cent."

The Rhineland Machine Works, represented by J. W. Blackford, when asked what would be the practical reduction of the duty on bearings from 45 to 35 per cent., stated that if the manufacturer of cars received the larger share of the benefit accruing from such a reduction he had every reason to be satisfied; and that the company felt it was itself also entitled to a margin of the profit caused by a reduction.

Louis Marburg, of Marburg Bros., estimated that the actual wholesale price reduction which will be caused by a 45 to 35 per cent. cut of the duty would be about 5 per cent. of the present wholesale price to manufacturers.

The R. I. V. company was of the same opinion with regard to a wholesale price reduction.

J. H. Lehman, of the J. H. Lehman Mfg. Co., stated that in the case of his company, if the tariff were actually reduced, the manufacturer would get the full benefit of the reduction, whatever it makes.

A prominent importer stated that the reduction to the car manufacturer will amount to from 5 to 7 per cent. of the present price, if the proposed reduction of duty to 35 per cent. goes through.

To Build Church Cars

CHICAGO, April 9—Formation of a $1,000,000 corporation to be known as the Church Motor Car Co., recently incorporated in Delaware, has just been announced to manufacture pleasure cars and trucks using the Church pneumatic system automatic motor, which has been developed by the Automatic Motor & Engineering Co., Chicago.

The incorporators of the new Delaware corporation are: A. G. Latter, W. J. Malony and N. P. Coffin. Manufacture of cars in quantities will commence in Chicago immediately, and it is expected to have the first model on the street by the middle of May and deliveries will commence, according to present plans, by September 1. Efforts are being made to obtain a factory site in Detroit, and the permanent plant will be established in that city, the Chicago factory being only temporary.

The car will be radically different from existing types so far as power plant is concerned, as it will employ the pneumatic motor and transmission system developed by Edmund S. Church. This involves a pneumatic clutch which takes the place of both clutch and gearset and also is automatic in that the ratio of engine speed to car speed varies automatically with the load. The system at the same time provides for pressure fuel injection pneumatic starter and tire inflater and pneumatic tire jacks. It it stated that the engine handles not only gasoline but kerosene and even crude oil as fuel. The motor is four cylinders, 3 1-2 inches bore and 5 inches stroke, and rated by the maker at 90 horsepower. The car will appear in three models of 132 inches wheelbase and the bill includes a touring car, roadster and speedster. It is to be sold at about $2,500.

United Rim Co. Dissolves

AKRON, O., April 8—The United Rim Co., of this city, held a formal meeting Friday and decided to dissolve. R. B. Beebe, its sales manager, was appointed trustee to wind up the company's affairs as soon as possible, which will be not later than June 1. The United Rim Co. is a holding company owning the rim patents of Goodyear, Goodrich, Morgan & Wright, Hartford, G. & J., Diamond and Continental.

Truck Industry Grows 200 Per Cent.

Estimated Production for 1913 Is 51,586—Total Value of Vehicles Made Estimated at $98,288,872—There Are About 280 Gasoline Vehicle Manufacturers and Thirty-Two Electric Vehicle Makers

NEW YORK CITY, April 9—Surprisingly rapid growth by the commercial vehicle industry is indicated by reports of production received from manufacturing companies during February and March, 1913, by the National Association of Automobile Manufacturers. The results of this second census of the industry by the association are given in detail in a statistical report just issued to the trade and are compared with the results of the previous census to show the increases in output and the fluctuations in average prices from year to year.

The total output of commercial vehicles of all kinds and types reported for the year 1912 by 170 companies was 21,939, as compared with a total of 10,655 reported for the year 1911 by eighty-five companies, and 10,374 reported for all preceding years combined up to the end of 1910 by the same eighty-five companies. It is believed these companies represented about 75 per cent. of the total production of the country, while the 170 companies reporting for 1912 and 1913 probably represent about 90 per cent. of the total output.

The estimated production for the year 1913 is 51,586 vehicles.

The figures given show that each year's output closely approximates the total output of all preceding years combined, thus:

Reported output prior to 1911	10,374 + 25% =	12,968	
Reported output during 1911	10,655 + 25% =	13,319	
		26,287	
Reported output during 1912	21,939 + 10% =	24,133	
		50,420	
Estimated output during 1913	51,586 + 10% =	56,744	

This is a rate of growth of approximately 200 per cent. annually.

The total value of the vehicles reported made in 1912 was $42,942,828, and of the estimated reported production in 1913 $98,288,872. These figures compare with an aggregate value of $22,292,321 for the vehicles produced in 1911 and of $20,485,231 for all vehicles manufactured prior to the end of 1910.

With the exception of a dozen or fifteen companies, all of those that failed to send in reports are relatively new companies that produced few or no vehicles last year or are older companies whose individual output probably did not reach fifty vehicles in any case.

Index of Industry's Growth

The data furnished in the reports provide a valuable index of the growth and trend of the motor truck industry. Some makers may be disappointed in their expectations for the present year, but on the whole the estimates of production for 1913 are believed to be fairly conservative, as nothing was to be gained by any manufacturer in exaggerating his figures, because the census was a secret one in which names of companies were not to be attached to the reports.

Although 280 gasoline vehicle manufacturers and thirty-two electric vehicle makers are listed in one of the leading automobile directories, the association has been unable to elicit replies to communications of any nature from about 40 per cent. of them, from which it is assumed that they are not very active or important.

Reports received from the 170 companies are classified as follows: Gasoline vehicle makers, 140; electric, twenty; mixed system, three; gasoline fire apparatus, seven; tricars, three; tractors, two; steam, one. The gas-electric vehicles and the tractors are made by the electric and gas vehicle makers.

Analysis of the reports shows that the largest and most rapid increases in numbers have been made in the 1,000, 1,500, 3,000 4,000, 6,000 and 10,000-pound capacities in gasoline vehicles and in the 1,000, 2,000, 4,000 and 7,000-pound sizes in electric vehicles.

There has been a notable tendency to change models, particularly among the gasoline vehicle makers. Taking account only of companies making full reports for both years, 1912 and 1913, it is found that thirty-five models have been dropped by the gas car makers and forty-four new models added, while the electric vehicle makers have dropped twelve models and added five. The changes are most pronounced in the 2,500, 3,000, 5,000, 7,000, 8,000 and 12,000-pound sizes in gasoline vehicles and in the 1,500, 2,000, 3,000 and 7,000-pound capacities in electrics.

The mean average price of all the commercial vehicles produced in 1912 was $1,957.37; that of the gasoline cars, $1,868.95, and of the electric vehicles, $2,465.18. In 1911 the average value of all gas trucks sold appeared from the records to be $2,079.16 and for all preceding years combined was $1,955.70, while in 1911

Automobile Securities Quotations

The rubber quotations still maintain the fluctuating qualities exhibited during the last few weeks. Goodrich has jumped 5 points and Goodyear has fallen off the same amount. The other rubber quotations have been fairly steady, Ajax-Grieb being at the same figure as last week. The other quotations will be found to be fairly strong as may be expected from the fact that the reports of flood disasters have proven for the most part greatly exaggerated.

	1912		1913	
	Bid	Asked	Bid	Asked
Ajax-Grieb Rubber Co., com	..	..	150	165
Ajax-Grieb Rubber Co., pfd	..	..	94	99
Aluminum Castings, pfd	..	..	98	100
American Locomotive Co., com	39	39½	37	37¼
American Locomotive Co., pfd	106	106½	103	106
Chalmers Motor Company, com	..	..	130	140
Chalmers Motor Company, pfd	..	..	98	102
Consolidated Rubber Tire Co., com	11	17	19½	23
Consolidated Rubber Tire Co., pfd	20	40	60	75
Firestone Tire & Rubber Co., com	234	236	272	280
Firestone Tire & Rubber Co., pfd	108	110	104	106
Fisk Rubber Co., com	..	..	..	..
Fisk Rubber Co., pfd	..	..	95	102
Garford Company, preferred	..	..	99	100½
General Motors Company, com	30	31	30¼	33
General Motors Company, pfd	78	79	77½	80
B. F. Goodrich Company, com	..	..	37½	38
B. F. Goodrich Company, pfd	..	..	97	100½
Goodyear Tire & Rubber Co., com	397	400	330	340
Goodyear Tire & Rubber Co., pfd	108	110	100	101½
Hayes Manufacturing Co	..	..	..	90
International Motor Co., com	..	..	5	10
International Motor Co., pfd	..	..	30	40
Lozier Motor Company	..	..	..	20
Maxwell Motor Company, com	..	..	5	10
Maxwell Motor Company, 1st pfd	..	..	50	70
Maxwell Motor Company, 2nd pfd	..	..	20	35
Miller Rubber Company	..	..	176	180
Packard Motor Company	104	107	98	102
Peerless Motor Company, com	..	..	35	45
Peerless Motor Company, pfd	..	..	95	100
Pope Manufacturing Co., com	37	40	17	22
Pope Manufacturing Co., pfd	78	80	54	57
Reo Motor Truck Company	8	10	11¾	12¼
Reo Motor Car Company	23	25	21	22
Rubber Goods Mfg. Co., pfd	100	105	100	105
Studebaker Company, com	..	..	30	33
Studebaker Company, pfd	..	..	90½	92½
Swinehart Tire Company	..	..	92	95
U. S. Rubber Co., com	56	57	66½	66¼
U. S. Rubber Co., 1st pfd	114	115	108	108½
White Company, preferred	..	..	107½	109
Willys-Overland Co., com	..	..	64	69
Willys-Overland Co., pfd	..	..	92	98
Portage Rubber Co., com	..	..	38	42
Portage Rubber Co., pfd	..	..	90	94

the average price of all electrics reported was $2,759.66, and for all preceding years was $3,369.72.

Fluctuations in prices of the various sizes of both gas and electric vehicles over a period of years show that the price of the 1,500, 3,000, 4,000, 8,000 and 10,000-pound sizes of gas vehicles have decreased materially, while the prices of the 2,000 and 6,000-pound sizes have increased notably. In electric vehicles the average prices of the 1,000, 2,000, 4,000, 8,000 and 10,000-pound sizes have been reduced while in the 1,500, 3,000, 7,000 and 11,000-pound sizes they have increased.

Output and Valuation of Different Classes of Commercial Vehicles

Reported by 170 companies in February and March, 1913.

	1912		1913	
	No. Cars	Aggregate Value	No. Cars	Aggregate Value
Gasoline vehicles	20,052	$37,474,308	44,245	$83,073,200
Same, value estimated*	100	162,357	1,275	2,620,847
Fire apparatus	140	843,900	232	1,422,250
Same, value estimated*	135	813,760	260	1,595,200
Gasoline tricars	58	23,610	1,500	662,500
Gasoline tractors	42	122,500	800	2,125,000
Electric vehicles	1,351	3,330,568	2,736	6,627,750
Mixed systems	59	163,800	25	108,125
Steam vehicles	2	8,025	13	54,000
Totals	21,939	$42,942,828	51,586	$98,288,872

NOTE—Production reported with no values given; values calculated on average prices of other vehicles of same kind and capacity.

Output of Commercial Vehicles Compared by Years

	Reported by 85 companies:		Reported by 117 companies:	
	Sold prior to 1911	Sold in 1911	Made in 1912	Output for 1913
Gas vehicles	10,230	10,451	20,528	48,867
Electric vehicles	144	204	1,351	2,736

Average Prices of Commercial Vehicles Compared by Years

	Prior to 1911	During 1911	During 1912	For 1913
Gas vehicles	$1,955.70	$2,079.16	$1,868.95	$1,877.57
Electric vehicles	3,369.72	2,759.66	2,465.18	2,422.44

No More National Truck Shows

NEW YORK CITY, April 7—The executive committees of the N. A. A. M. and Automobile Board of Trade at their meeting on April 3 reached the decision that no more truck shows were to be held in New York and Chicago hereafter. This action has been foreshadowed ever since the closing of the shows in these two cities this year, and now has become definite.

Incidentally, the two bodies decided that it would be of advantage to hold one large pleasure car show instead of two, and it was decided to exhibit all the automobiles, during a 1-week show, in the Grand Central Palace, where plenty of space is available, while the Madison Square Garden has proved more and more inadequate during the last few shows.

While in previous years the ground floor and two stories of the Palace were used for automobile exhibitions, for 1913 three additional floors will be devoted to this purpose, giving a total of six floors. Each of these has 55,000 square feet, making a total of 330,000 square feet. If necessary, even more space could be provided. The Palace has ample elevator facilities so that the show will be as easy to view as if all the cars were stationed on one or two floors.

Automobile Blue Book Sues A. C. A.

NEW YORK CITY, April 7—The Automobile Blue Book Publishing Co. has filed suit, in the District Court of the United States, Southern District of New York, against the Automobile Club of America, alleging infringement by the latter of the copyright granted on various editions of the several volumes of the Blue Book.

The bill of complaint tends to show that the Tour Book of the Automobile Club of America, published in recent years, and, according to the Blue Book, to be published again in 1913, utilizes the information gathered laboriously by the editors of the Blue Book and compiled in this publication. It is claimed that the information thus collected and published has been rearranged and put in a new guise.

After lining up the preliminary evidence, the bill of complaint prays for a perpetual injunction restraining the A. C. A. from publishing and selling the Tour Book, the sale of which, it is claimed, actually injures the business of the Automobile Blue Book.

Third Motor Spirit Plant

Another Refinery for New Fuel Added to Standard Oil Plant at Neodesha, Kansas

CHICAGO, ILL., April 5—A third refinery for production of Motor Spirit, the new fuel, will be in operation by the first of next year. This refinery will be an addition to the present oil refining plant of the Standard Oil Co. at Neodesha, Kan. The addition, including the stills for the production of the new fuel, will represent an outlay of about $200,000. Motor spirit will be distilled by the Burton process of pressure distillation under royalties from the Standard Oil Co. of Indiana.

Two other refineries are producing the new fuel, one at Whiting, Ind. and the other at Alton, Ill. At the Whiting plant about $2,000,000 worth of apparatus has been installed to produce and handle motor spirit. The production of this plant is about 50,000 gallons of motor spirit daily and that of the Alton plant is about 10,000 gallons daily. The production of both plants is being increased as rapidly as new stills can be put in commission.

Brown Co. Sues 35 Per Cent.

NEW YORK CITY, April 9—The Brown Co., Syracuse, N. Y., has filed suit in the U. S. District Court, Southern District of New York, against the Thirty-five Per Cent. Automobile Supply Co., claiming that the latter are infringing upon patent No. 43,241 granted on November 5, 1912, to Carley Gould Weld, assignor to the Brown company. The subject-matter of the patent is an engine-driven tire pump of the spark-plug type.

Market Changes of the Week

This week's markets were noted for their steadiness, few changes taking place. Scrap rubber rose $.00 1-8 on Saturday, calling at $.10. It remains in a firm position. Stocks abroad are light and strength there is reflected here. Cottonseed oil fluctuated throughout the week its highest price being $6.85 a barrel, and the closing $6.70, with no change. There has been some falling off in the consuming demand, according to all accounts, especially with lard showing a weaker tendency. The movement of petroleum into consuming channels continues liberal and the market here retains a firm tone. Both petroleums remained constant, Kansas at $.88 and Pennsylvania at $2.50 per barrel. There was an absence of new developments in the fish oil markets. The trading was generally limited to jobbing quantities. Gasoline remains firm at $.22 1-4. Tin this week fluctuated but managed to close at $48.00, experiencing no change, an unusual event. Electrolytic and Lake coppers both rose, the first $.00 1-4 and the second $.00 1-8. The lead market is quiet and slightly easier, spot and nearby shipment commanding $4.35 at the 100-pound rate. Raw Italian silk rose again $.05, closing at $4.35.

Material	Wed.	Thurs.	Fri.	Sat.	Mon.	Tues.	Week's Change
Antimony, lb.	.07⅝	.07⅝	.07⅝	.07⅝	.07⅝	.07⅝	.....
Beams & Channels, per 100 lbs.	1.61	1.61	1.61	1.61	1.61	1.61	.....
Bessemer Steel, ton.	29.00	29.00	29.00	29.00	29.00	29.00	.....
Copper, Elec., lb.	.15¼	.15¼	.15⅜	.15⅜	.15⅜	.15⅜	+.00¼
Copper, Lake, lb.	.15¼	.15¼	.15⅜	.15⅜	.15⅜	.15⅜	+.00⅛
Cottonseed Oil, bbl.	6.70	6.70	6.85	6.78	6.79	6.70	.....
Cyanide Potash, lb.	.19	.19	.19	.19	.19	.19	.....
Fish Oil, Menhaden, Brown	.33	.33	.33	.33	.33	.33	.....
Gasoline, Auto, 200 gals.	.22¼	.22¼	.22¼	.22¼	.22¼	.22¼	.....
Lard Oil, prime	.94	.94	.94	.94	.94	.94	.....
Lead, 100 lbs.	4.35	4.35	4.35	4.35	4.35	4.35	.....
Linseed Oil	.47	.47	.47	.47	.47	.47	.....
Open-Hearth Steel, ton	29.00	29.00	29.00	29.00	29.00	29.00	.....
Petroleum, bbl., Kansas crude	.88	.88	.88	.88	.88	.88	.....
Petroleum, bbl., Pa., crude	2.50	2.50	2.50	2.50	2.50	2.50	.....
Rapeseed Oil, refined	.68	.68	.68	.68	.68	.68	.....
Silk, raw Italy	....	4.30	....	....	....	4.35	+.05
Silk, raw Japan	....	3.70	....	....	....	3.70	.....
Sulphuric Acid, 60 Baumé	.90	.90	.90	.90	.90	.90	.....
Tin, 100 lb.	48.00	47.60	47.65	47.75	47.80	48.00	.....
Tire Scrap	.09⅞	.09⅞	.09⅞	.09⅞	.10	.10	+.00⅛

Non-Poppet Motors Influence Poppet Types

Springs between valve stem and cam silence poppet valve action

Part II

By E. P. Batzell

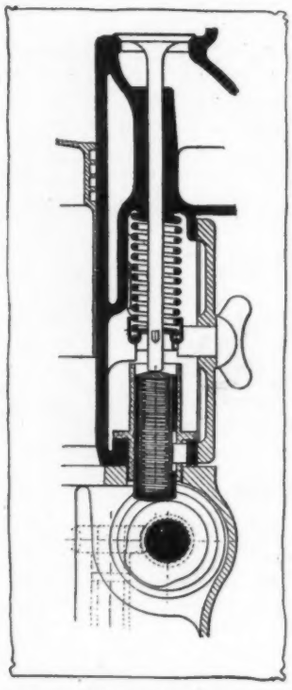


Fig. 3—Telescopic valve tappet on Germain motor

A GREAT deal more of attention is being paid nowadays towards the silencing of the noise arising from the valve tappet striking the valve stem when starting to lift it, and also the noise of the valve tappet striking the lifting cam, which takes place when this tappet does not follow the cam at all times. The first of these noises exists even at the slowest motor speed, unless special silencing means are employed. The other, that between cam and tappet, generally appears only at fairly high motor speed, when the strength of the valve spring is not sufficient to keep the lifted parts in constant contact with the cam.

Neither of the two sources of noise mentioned was objected to until the advent of the Knight sleeve valve engine. They were accepted as more or less unavoidable features of the high speed automobile motor. Motor building practice of that time indicates this, inasmuch as then there were in use valve and tappet clearances of .010 inch to .0156 inch. The tappet mechanism at the valve stem end was fully exposed, no particular attention being given to make extra light valve lifting parts and springs of ample strength, all of which is rendered worse in the matter of noise by the simultaneous employment in some instances of cam shapes especially adopted for quick valve lifting and closing.

In comparison with the above the present conditions show a marked decrease of the heavier roller type of valve tappets. For the sake of silence the most frequently encountered valve and tappet clearances amount only to a few thousandths of an inch, for instance .004 inch and as low as .002 inch. The valve tappet ends striking the valve stem are sometimes covered with a semi-elastic material to prevent a metal to metal contact. Almost in all cases the valve and tappet mechanism is inclosed, either by a single cover for a number of valves or by individual caps for each valve. The weight of valve parts, their motion and the valve spring strength are being carefully regulated in accordance with the anticipated motor performance. The silencing means mentioned are most often found in practice because they involve no radical changes in the motor construction. At the same time they are not fully accomplishing the results desired, as they give a silent valve system only for a certain range of motor speed and also only a temporary one.

Although the methods of attaining silence so far mentioned have produced satisfactory results at ordinary speeds it is noticeable that considerable noise is still generated when running fast. Small tappet clearance and valve covers are not sufficient to bring the poppet valve motor into competition with the non-poppet valve type in the matter of silence. A continuous quiet contact between valve stem and tappet at very high motor speeds may be obtained by using extra strong valve springs, but this is not practical on account of increased liability of spring breakage, besides much wear in the cam and in the whole valve lifting mechanism.

Various means have been adopted to reduce the sound made by the tappet striking the valve stem. In Fig. 3 is shown such an arrangement of the Germain motor. Here the tappet is composed of two parts telescoped one into the other and spread from each other by an inside spring, which is made considerably weaker than the valve spring. Thus the upper tappet part by action of the internal spring is forced against the valve stem end, remaining in constant contact with it. The minor variations arising in the valve mechanism length, to take care of which the valve and tappet clearance is provided in the ordinary motor, in this construction are taken up by the deflection of the same internal spring, the actual tappet clearance being inside and at the bottom of the external tappet part. In this location the clearance can be filled with oil, which will help to muffle the noise of contact between the two parts, the noise also being less audible because the actual contact takes place inside the mechanism.

Constructional Accuracy Necessary

A construction of this sort can serve its purpose well when the parts are accurately made. It gives a quiet valve action when the clearance in the tappet parts is small, which, however, it is difficult to maintain for a long time, because one part hammers out the other. Hardening on the inside improves matters, but it affects the shape of the parts, which are preferably thin. Grinding after the hardening will restore their shape, but this is a difficult operation on the inside surface of the outer tappet part. Hardening makes it also probable that minor defects in the material and its treatment in time are liable to bring forth cracks in the thin parts due to the constant pounding. As a whole, this construction requires considerable attention in manufacture, as well as in its maintenance, at the same time giving but a slight advantage over the ordinary arrangement, when small tappet clearances and valve covers are used. In another Germain construction the interior of the tappet parts is filled with felt in place of the spring.

Among other details on which depends the noisy or silent action of poppet valves the actual amount of valve lift is important. The greater the distance through which the valve is made to travel the greater the inertia to be overcome at the turning points of the reciprocating motion with a resulting increase in the noise when the cam strikes the valve stem. And where the cam is not immediately under the valve stem but is situated at one side, acting through a rocker, there is an opportunity for further development of objectionable noise according as to whether the cam

lift, considered apart from the actual valve lift, is great or small.

Attempts have been made to gain the advantages of a small lift cam simultaneously retaining a larger valve lift and the desired timing, by using a tappet lifting rocker anchored as shown at R, Fig. 4, whereby the cam lift is multiplied at the tappet end of the rocker. A cam constructed for a small lift offers the following advantages: It is more easily shaped in accordance with the requirements of an efficient valve opening, the maximum size of which can be reached through less degrees of the rotating cam motion. With the rocker arm equipped with a roller for following the cam it is possible to give the valve a very gradual initial lift, also letting it down to its seat in the same manner, this without any material sacrifice in the character of the valve opening. Of course such a valve lifting has to be accelerated more during another portion of the period, requiring heavier valve springs for the same degree of quietness. The smaller cam obviously permits also a more compact cylinder and crankcase construction, less distance being required between the crank and camshafts to make their parts clear each other properly, which is particularly important with the popular long stroke motors. The valves are thus brought nearer towards the cylinder which gives a better, more efficient and lighter construction all around.

Rocker Arms Re-introduced

It is noticeable that quite a number of modern motors again are being equipped with valve lifting rocker arms, which were used very extensively in the early days of the automobile industry, but which were discarded later on. No doubt some purposes are well served by them, although with added complication, and with more parts in the valve mechanism that are liable to wear out and cause noisy action. Only very careful execution of the rocker arm mechanism can warrant their reintroduction for the purpose of making a more silent valve action.

One of the most interesting constructions for a poppet valve lifting mechanism is the Chenard and Walcker arrangement represented at B, Fig. 4. It serves as an example illustrating the extreme of measures taken thus far towards silencing the poppet valve action. In fact, this construction in connection with one permitting a quiet closing of the valves, like the Adler previously described, should form a combination giving about the most silent results that can be expected.

The camshaft C, in the Chenard and Walcker motor, is inclosed in a compartment separate from the crank case, to which compartment oil is supplied positively through a bottom opening from a by-pass of the main oil feeding line. Thus the camshaft compartment is filled with oil to some height above the cam and above the lower end of the valve tappet, the oversupply of oil flowing back into the crankcase through another opening provided at the proper oil level. The valve lifting mechanism includes a rocker arm A riding on the cam, but acting upon the valve tappet through an intermediate flat spring S, the latter being secured to the rocker itself and bearing against the lower end of the tappet, which it lifts into constant contact with the valve stem. Consequently, in the whole mechanism there are no clearances between the component parts, which would have to be passed through before the parts are in working contact. No noise could be generated here as in instances when the parts strike one another. However, the arrangement of the rocker arm, its spring and the valve tappet offers sufficient clearance in their motion, so that the variable length in the valve parts can be taken care of in the space between the rocker and the spring. The relative motion of these latter parts is merely a rolling one during most of the time when the valve is to be lifted. And even when this rolling motion becomes a straight lifting one, just before the valve leaves its seat, there is an oil film present between the rocker surface and that of the spring, which cushions their contact in the absence of the rolling motion.

The whole construction affords a silent valve lifting action and at the same time it reveals only remote possibility for such wear in it, which in time would result in noise audible outside. The valve tappet has also very little side thrust to bear, except that caused by the slight angularity of the rocker spring against the tappet, and by the eventually not exactly central and parallel relative motion of this tappet and of the valve stem. The latter cause for side thrust is not a defect of construction, but would follow from wear in the guides or uneven tension of the valve spring. The possibility of harmful wear is greatly reduced in this construction by the following means: The supply of oil to the lower end of the tappet should provide ample lubrication of the tappet guiding bushing, which, moreover, cannot be pounded out, as it is frequently done in the case of common poppet valve motors, because the side thrust is slight. The tappet lifting rocker arm is pivoted with a long leverage reducing the motion in its pivot pin, and the latter is also submerged in oil.

Surfaces Require Hardening

The greatest amount of real sliding motion in this construction occurs between the cam and its following rocker part, but proper hardening of their surfaces will render the wear negligible, especially in the presence of an excess of lubrication. Even when the contact surfaces of these parts would wear off somewhat this will not be followed by noise, inasmuch as the character of their relative motions remains practically unchanged. Also the continuous contact between all mechanism parts is interrupted, due to the action of the flat spring. Some noise would be apt to arise if improper treatment of the parts, or uneven distribution of their material, should leave soft spots on the cam and rocker of the sort that can be pounded out into depressions in the even surface, thus giving great irregularities in the lifting or settling motion of the valve parts. Otherwise it is only up to the strength of the valve and the rocker springs to preserve these parts in continuous contact at high motor speed.

The Chenard and Walcker motor is built with comparatively large cams, the camshaft proper being in size equal to the size of crank pins in the two-bearing crankshaft. This, together with the housing of the camshaft, adds considerably to the width of the crankcase. However, the valves are with advantage kept close to the cylinders, which is rendered possible by offsetting them from the line of the camshaft, at the same time without altering the regularity of their motion, which is transmitted through the rocker. The large clearance available between the rocker and its spring permits the construction of cams of an easy shape. At the same time they can be made so that the maximum valve opening after being reached remains constant for some duration of the suction stroke, giving a condition very favorable for a good cylinder filling at high speeds. The same applies also to the cam and rocker construction, Fig. 4, this also serving as an example where a good valve opening is obtained with small cams.

(To be concluded)

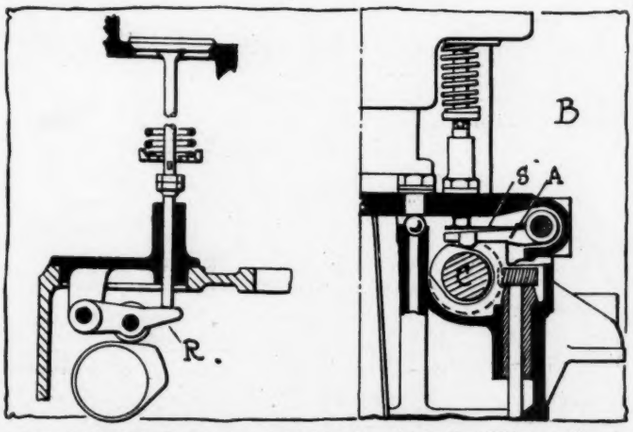


Fig. 4.—Method of valve operation in which the lifting action is multiplied by rocker arm. B, Chenard Walcker construction, showing introduction of flat spring between rocker and valve stem

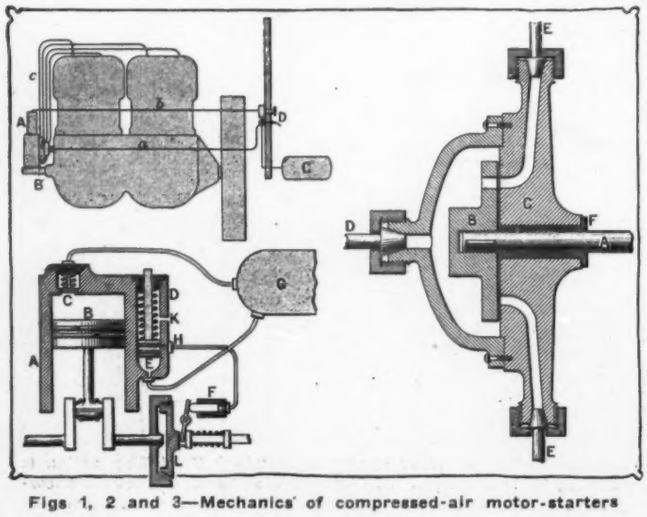
Digest of the Leading Foreign Journals

Compressed-Air Motor-Starters Found Least Cumbersome and Sufficiently Reliable By French Builders, Economy Also Considered—Pre-Ignition and Its Avoidance —Some Examples of Cast-Steel Truck Wheel Construction—German Crisis

AIR Preferred for Starters in France—Given the choice of starting an automobile motor either by means of a special explosive charge, such as one formed from acetylene gas or by a forcible injection of gasoline vapor, or by an electric motor or by a compressed-air motor, the French market is developing a preference for the latter form of auxiliary device. The reasons are set forth briefly by D. Renaud. The objection to a gasoline vapor charge is that it is difficult to regulate it so as to have it unfailingly ignitable, and while acetylene detonates easily, does not condense in a cold motor and [any mixture from 3 to 65 per cent. being explosible—ED.], an overdose of this gas may cause a much more violent explosion than is desirable. When ignition fails, it is necessary to go through the process of cleaning the cylinders of the poor mixtures before trying to introduce new and better ones, and this process is more laborious than starting by cranking. With regard to the electric starting equipments it is mentioned that the effort required for starting a motor amounts to about 60 per cent. of the power developed by the motor when it is in operation at a comparable angular speed of the crankshaft, and that an electric equipment powerful enough to overcome such a resistance must be so large that it becomes an encumbrance and impracticable for the average owner of a car otherwise mechanically operated. [The author knows of course that much may be said against these objections and for the systems which he rejects, but apparently he means to suggest that the viewpoints mentioned by him should be decisive in a general judgment on the subject.—ED.]

Among the compressed-air devices, some act directly on the motor shaft, and others send the air to the cylinders to act upon the pistons, one after another, until the motor is running normally.

The first of these types does not depend upon finding the motor pistons in a certain position to start with and is represented in the Barbey self-starter which is used on Delaunay-Belleville cars and consists in a four-cylinder air motor mounted in front of the gasoline motor and arranged to be clutched to the motor shaft. It receives compressed air from a tank on the dash when the motor is to be started and, on the other hand, is driven by the gasoline motor when the tank must be refilled.



Figs 1, 2 and 3—Mechanics of compressed-air motor-starters

On account of the smaller equipment involved, greater interest attaches to the second type. It is based on the ascertained fact that a gasoline motor in good order always comes to rest with all of the four pistons at the same height and that one of them therefore always is in the position of a half-finished power stroke. If air is sent to the cylinder where the piston is in this position, it will thus act upon this piston exactly as the gas explosion acts during normal operation, and in order to effect a start safely it is only necessary to arrange a distributer device which will send air first to the cylinder which is found in the position referred to and successively to the other cylinders in the order in which they get into the same position. As soon as the speed imparted to the crankshaft is sufficient to draw an ignitable charge into one of the cylinders and to effect the compression of the same, the start is bound to follow, and the moment an explosion occurs from which the pressure is greater than that of the air, the automatic valves in the distributer cease to admit air.

All the apparatus necessary for assuring this result comprises a special distributer device connected to the different cylinders by tubes of small diameter, a special automatic intake valve for the compressed air in each of the cylinder heads and an air-tank connected to the distributer. The compressed air is usually produced by means of a small pump actuated at the driver's option from one of the gear shafts, and it is usually sent first into a small reserve tank. The general arrangement is shown in Fig. 1, in which A is the air-tank, B the distributer, C the reserve tank, D the control organs, *a* tubes from the reserve, *b* tubes to the reserve and *c* tubes to the cylinders. The distributer is the only organ presenting features not familiar from other mechanical devices. It must be so built as to avoid air leaks when it is feeding the cylinders and to avoid friction when it is not operating. Fig. 3 shows one such arrangement. A is a half-speed shaft driven from the crankshaft, B a rotary slide valve keyed to rotate with A but capable of a small longitudinal displacement on the shaft, C the distributer-disk forming one side of the air-collector in which air is received through the valve D from the air tank, E the air conduits to the cylinders, F the bushing in which shaft A turns. The air pressure holds the ground face of the rotary slide valve tightly against the distributer-disk C, as soon as air is admitted. The hole in the slide valve can be made large enough—in the form of a curved slot—to make sure that air will reach one of the cylinders when first admitted, even if the pistons are not found strictly midway between centers, and thereafter the slide valve is rotated and takes care of the successive distribution to the four cylinders. When the start is effected and the air supply is cut off, the slide valve is detached from the face of the distributer and revolves without friction. This device need only be from 2 1-2 to 4 inches in diameter.

A somewhat different distributer is used in Delahaye fire engine motors and has so far proved itself reliable. It was designed and made by Letombe and Aucoc and is shown in Fig. 4. It forms a feature in a general arrangement like that represented in Fig. 1. This distributer has four piston valves D placed 90 degrees apart around a cam disk B keyed upon the camshaft of the motor. The space at the outer ends of the pistons is in constant communication with an annular space C in which the compressed air is received by way of R, and from which four conduits M lead to the cylinders. When air is admitted, all the pistons are pressed against the cam-disk, but only the one opposite to the notch *b* in this disk can be displaced toward the center of the device, thereby uncovering the corresponding air conduit to one of the cylinders. When the air pressure ceases, the pistons also cease to press against the cam disk and the device revolves without appreciable friction.

The intake valve for the air which must be provided in each of the motor cylinders opens from the outside inwardly and its spring must be strong enough to resist the ordinary suction of the intake stroke, for which purpose a four pound spring pressure [per square centimeter] is sufficient, even if the carbureter is throttled down.

A compressed-air motor-starter can be arranged so as to require no attention with regard to the filling of the air tanks. To this end, the compressor pump is connected with one of the shafts in the motor by a cone clutch on the plan shown diagrammatically in Fig. 2. A is the compressor cylinder with piston B and valve C connected by a tube with the air tank G. In the adjacent small cylinder D the piston E is pressed toward the bottom by a spring, against the resistance of the air pressure underneath. If sufficient to raise the piston until the port H is uncovered, the air pressure travels through a tube to the small cylinder F and drives the piston in the latter against a lever which disengages clutch L and releases the compressor shaft from the driving shaft. Obversely, if the air pressure under piston E is low, the clutch springs pushes the clutch into engagement and puts the compressor to work. K is a safety port limiting the air pressure to a maximum, being necessary because a relief port in cylinder F, for example, would leave too small a margin of air pressure to work with, so that the clutch would be continually engaging and disengaging.—From *Omnia, March 22.*

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POSSIBLE Causes of Premature Ignition.—While great progress has been made in this respect, no motor builder can yet guaranty absolute immunity against premature ignitions. They may occur as well during the induction as during the compression stroke in a four-cycle gasoline motor. In two-cycle motors with fresh-air scavenging they can occur only during the compression, but in the two-cycle automobile motors, in which the burnt gases are driven out by the fresh charge under light pressure, ignition may take place also during the charging period preceding the compression.

If in a four-cycle motor the incoming charge takes fire, a loud detonation is heard in the induction tube, but damage is rarely done and the motor usually continues to operate. The usual cause is a mixture [for the preceding explosion] which is too poor, too rich or not homogeneous, so that a part of it burns very slowly and remains aflame after the exhaust is ended. A weak spark which ignites only a very small portion of the charge may cause similar effects. In all these cases the ignition is plainly due to the incoming charge meeting a flame upon entering the cylinder. The same condition, with its slow fires and incomplete combustions, can also cause unburnt gases to become ignited in the muffler. The remedy is suitable carbureter adjustment, a powerful or multiple (dual) spark and the avoidance of dead space in the combustion chamber.

Premature ignition during the compression is, on the other hand, not noisy. It often passes unheard, but its effects make themselves felt very soon. Diagrams taken during such explosions show that the gas pressure begins to rise at the middle of the compression stroke, increasing the torque of the motor

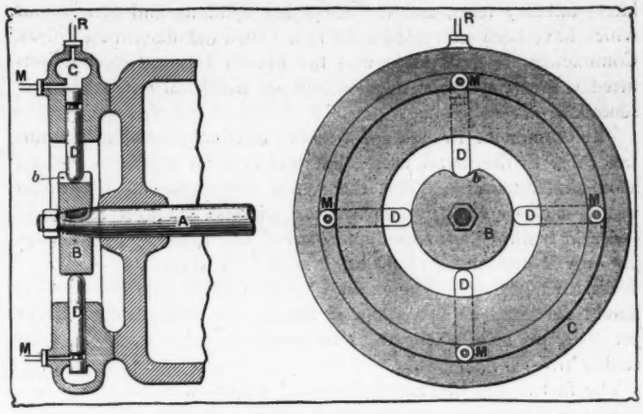

Fig. 4—Distributor for Delahaye starter of fire engine motor

shaft at that moment in an abnormal manner, and that it reaches altogether excessive values toward the end of the stroke. Moreover, as the dissipation of heat in the cylinder walls is at the same time interfered with, the sudden absorption of heat in the gas tension creates a negative area (in the diagram) which often annuls completely the positive work. The smallest of the inconveniences which then arise is the stopping of the motor. It is often preceded by heated bearings due to the expulsion of oil from between the friction surfaces under the exaggerated pressures. Obliged to take cognizance of this eventuality, motor builders have strengthened the motor shafts in order to avoid the fractures which previously occurred too often.

This kind of premature ignition may be due to mixtures which are too rich or contain a surplus of hydrogen, but it may also be caused by insufficient cooling of the cylinder, by poor insulation in a high-tension commutator, by an excess of lubricating oil, by the use of an oil which leaves carbon deposits and by the fouling of the cylinder walls due to tar or coal dust contained in the gas charges [the latter item referring apparently to the use of benzol as fuel].

The best means for obviating these damaging pre-ignitions consist, apart from the precautions mentioned before, in working always with very clean gas of small hydrogen-content and constant composition, without excess of lubricating oil and in refraining from pushing the motor to its power limit.

As the effects of pre-ignition is the more serious the higher the compression is, it may be characterized as imprudent to design a motor for average piston pressures as high as 6 or 6.5 kilograms per square centimeter. The exact cause of pre-ignition can in any case be detected without difficulty by a careful examination of the conditions.—From a communication by Prof. L. Letombe to the Society of Civil Engineers of France, February 7, reported in *Technique Moderne,* March 15.

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Crisis Expected in Germany—According to an insistent editorial article in *Auto,* the organ of the Society of German Automobile Engineers, the German automobile industry has during the past few weeks experienced serious setbacks in its export business and its representatives in the foreign countries have ascribed the rapid and untoward change to the American competition. An automobile show in Berlin at the earliest possible moment, and preferably during the coming summer, is suggested as a suitable remedy and a means for averting a crisis. What lies at the bottom of the trouble, however, it is admitted, is the hesitating slowness of most German manufacturers in adopting and organizing sound mass-production methods. It is thought an exhibition may furnish a strong object lesson on this point.

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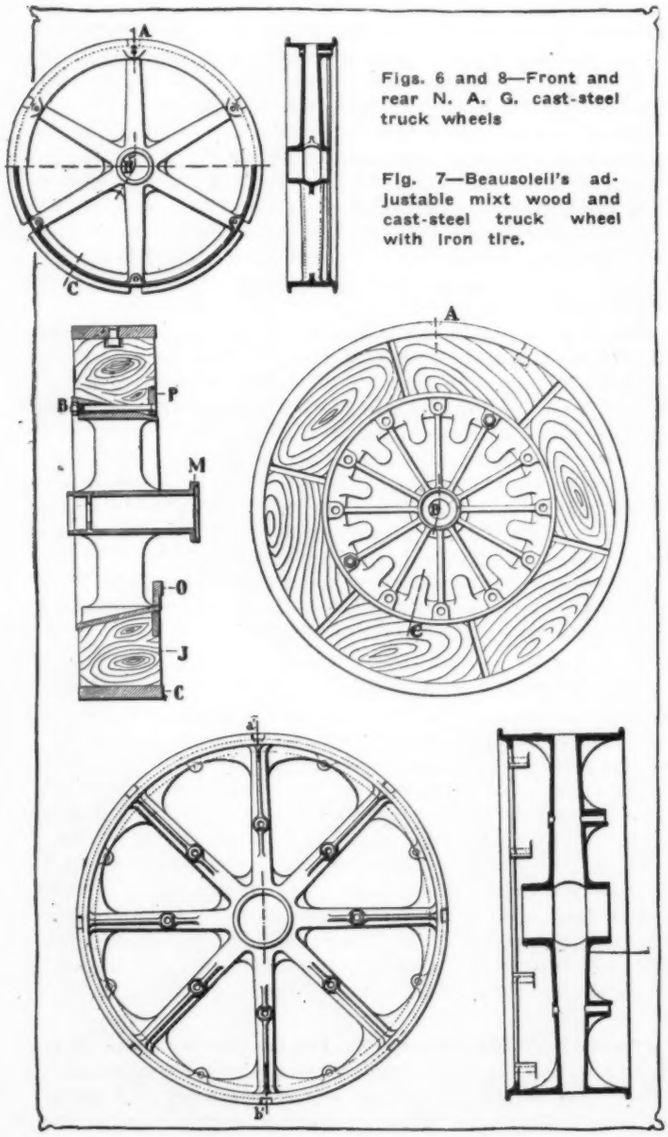
CAST-STEEL Wheels for Trucks—The orthodox view to the effect that wood wheels are the only ones which are fit for heavy truck service has been aired industriously in France of late in connection with reviews of the

latest military tests, and the one-sided opinions and conclusions which have been expressed have now called out dissenting voices. Commandant Ferrus steps into the breach for cast-steel wheels fitted with rubber tires in an article of which an extract is presented in the following:

The opinion of French constructors continues to be rather unfavorable to the metal wheel, but this opinion seems to rest on a misunderstanding. The theoretical objections to the metal wheel—lack of elasticity, brittleness, sluggish traction vibrations—are in truth well founded and proved, but these reproaches apply only to the metal wheel fitted with iron tires.

Wire wheels, now coming into fashion again for automobiles, would certainly be detestable if fitted with iron or steel tires; yet they are acknowledged to be excellent when equipped with rubber tires.

The fact is that in France the metal wheel—with rubber tires—has been condemned without serious trial. On the other hand, a glance at the development in Germany reveals the fact that the German truck builders employ the cast-steel wheel exclusively and that they claim for it the advantages of being cheaper than the wood wheel, notably lighter, unaffected by the weather and never in need of attention, having only the one defect of being practically unrepairable in case of severe accident and breakage. In its new regulations for subsidized motor trucks, which go into effect April 1, 1913, the German government has, moreover, made it obligatory to have these trucks equipped with cast-steel wheels.



Figs. 6 and 8—Front and rear N. A. G. cast-steel truck wheels

Fig. 7—Beausoleil's adjustable mixt wood and cast-steel truck wheel with iron tire.

The very real shortcomings of wood wheels are well known and those of steel wheels are less well known, but the experience gained abroad proves at all events that these possible shortcomings, whatever they are, are not prohibitive. The steel wheel should not be ostracised but tried. But the steel wheel without rubber tires has been tried and has been found wanting, having all the faults charged against it. The types to be examined are those steel wheels which have been used in France or abroad with rubber tires. Among these are the Fischer, the N. A. G., the Hugon and the Beausoleil.

The Fischer wheel is made at the electro-metallurgical works at Schaffhausen, Switzerland, and is poured from electrically made steel (Herault furnace). It is manufactured in two types, one which has hollow spokes and also a hollow rim and which is difficult to cast and correspondingly expensive, and another in which the spokes alone are hollow. Both are cast in one piece. The all-hollow type should be by far the best. It can be greatly deformed without breakage. It is light, a set of four for a five-ton truck weighing, without the tires, 500 to 550 kilograms.

The Neue Automobil Gesellschaft (N. A. G.) of Berlin employs a type the construction of which is shown in Fig. 5 and Fig. 7, representing respectively a front and a rear wheel. The sectional view under Fig. 5 is taken on the broken line ABC of the side view. These wheels are used for six-ton trucks, and the front wheel weighs 50 kilograms, the rear wheel about 135 kilograms. They are assembled in the middle plane by means of bolts, as clearly indicated in the drawings, and the solid rubber tire is mounted directly upon the cast rim.

Some interesting wheels for heavy trucks have been designed by Hugon, an engineer at Calais. The tread is formed of steel blocks, each of which is secured by a socket joint to a steel rod which passes radially through the wheel rim. But on the outside of the rim each steel block rests on a block of soft rubber, and the inside of the rim is lined with a thick band of the same material against which there is pressed a steel plate by passing the securing-rod for each block through all of these parts and threading a nut on its inner end. These wheels are in service on trucks of 2 1-2 and 6 tons used for the transportation of material at the Astricourt mines at Pas-de-Calais.

The Beausoleil wheel is of the mixt type. It comprises, as shown in Fig. 6, a hub of cast steel and an iron tire separated by a wood rim whose function is to deaden vibrations. This expedient of interposing a wooden lining between the metallic parts has been tried repeatedly, especially for vehicles intended for the colonies, and always with the worst possible results. It is in fact easy to understand that the wood will work loose under the influence of alternating drought and humidity and that the wheel will then soon be out of commission. But Beausoleil has had the ingenious idea of giving the cast-steel hub the form of a truncated cone, against which the wooden lining J may be tightened up by means of the bolts B and the plate P, and as the lining is composed of individual wooden blocks this adjustment can be made easily and without taking the wheel apart or dismounting it; in fact as a road repair. As also nothing prevents the use of rubber tires on a wheel of this type, its development may be worth watching.

The experience with sheet-steel wheels riveted together has not so far been commercially favorable, though many wheels of this kind have been turned out. It seems to be feared that the rivets will work loose, but this fear is perhaps not well grounded if suitable rubber tires are used [the fear relates perhaps mostly to that period in the life of a rubber tire when it is worn down and thin.—Ed.]. At all events, however, pressed-steel wheels, in which few rivets need to be used, would seem preferable, and their construction presents at the present time no special technical difficulties—none comparable with those which were encountered at first in the production of cast-steel wheels of small weight and which have been overcome only through the great progress accomplished lately in metallurgical processes and foundry practice.—From *Le Poids Lourd*, March 14.

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Engine Testing at the Northway Plant

By J. O. Heinze

¶ EDITOR'S NOTE.—*This paper is based on a report delivered by John O. Heinze at the January session of the Society of Automobile Engineers from the Motor Testing Committee, of which Mr. Heinze is chairman. The object of this report was to set before the various engineers what the Northway Motor & Mfg. Co. is doing in the way of testing motors, with the object that the various testing methods in use in other factories might be later presented before the society and that eventually the motor testing committee would be able to evolve some standardized form of testing apparatus for the various parts of the motor.*

Justification

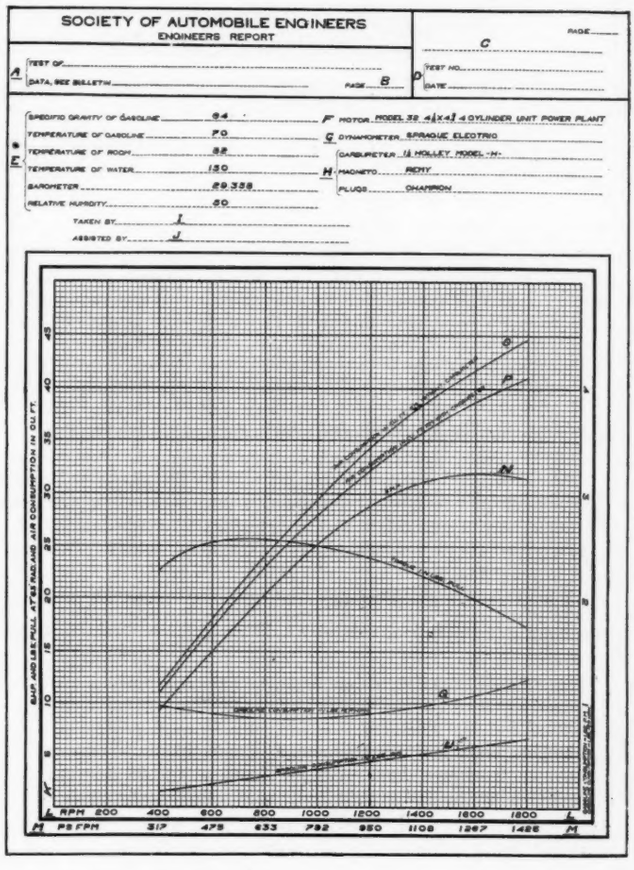
Professors in college laboratories have done a great deal of testing, and they have given us certain formulas to work by in our gasoline engine field, but unfortunately a great deal of this mathematical work is rather difficult for the average automobile engineer in the workshop, and we desire something more practical.

Were we to employ mathematics altogether we would a great many times go astray, for the reason that we all have to take into consideration the commercial end of automobile engines, the manufacturing advantages, machining ability and the general behavior of the product in the hands of the customer in general use. We have all been building engines and we have been varying our bore and stroke. We have been varying the individual elements of an engine, and we have been plotting horsepower curves along different lines.

A disadvantage that the automobile engineer has to put up with, differing from that experienced in electrical engineering and other branches of the engineering profession, is that we cannot go on the open market and purchase apparatus in the same way as the electrical engineers, who can go and purchase a voltmeter or ammeter or a Wheatstone bridge. We know no concern to go to and say "I want a complete set of apparatus for testing engines." The automobile engineer must design his own apparatus.

The testing done in colleges is very scientific. A professor can put an engine on the block and leave it there for a month, and in the course of his testing he will take gas analysis; will measure the heat losses with very delicate calorimeters; will measure the explosive temperature with a pyrometer; will measure the cylinder compression very accurately, and will measure the air resistance with venturi tubes, as well as making other scientific measurements. All these tests take a long time to make and are more or less delicate. Consequently, in the average laboratory we wish to resort to testing apparatus which gives us quick and practically accurate results, and I believe that these results will be just as accurate as most of the scientific work done in colleges. A great many pieces of testing apparatus which we would like to use have not been designed, and the apparatus which we have built and designed has been, in a measure, crude. As time goes on, however, more delicate instruments, giving greater accuracy, will be brought into use. It seems to me that we engineers should suggest the kind of apparatus to be used in the engine testing laboratories, so that we may all test our motors along similar lines, and then our results will admit of fair comparison.

As a committee we should suggest a standard curve sheet, a standard data sheet, and also certain essential tests, being careful not to be too scientific.—J. O. HEINZE.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MAGNETO REMY
PLUGS CHAMPION
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PS FPM SIP 475 633 792 950 1108 1267 1425

Fig. 1—Proposed standard curve sheet to be used for engine testing

I HAVE here a number of plans, diagrammatic views and apparatus and methods pursued in making tests at the Northway Motor & Mfg. Co. plant. They are not what you might consider the most scientific, but they are of practical accuracy and are such apparatus as give us comparative results from day to day so that we know what we are doing.

Fig. 1 is a sheet which might be adopted as a standard curve sheet to be used by the engineers, and on which I have plotted curves representing different elements in the operation of an engine. On the top of this sheet is the name of our Society, "Engineer's Report," and underneath it the subject of the test. Whatever the test is, whether of a certain make of carbureter, magneto or engine, should be written in here. At A is where we should record that this test is entered in our bulletin of a certain date, and at B the page number of our yearly book or bulletin. At C is the record that the individual engineer can keep in his own files. At D is recorded the test number and the date

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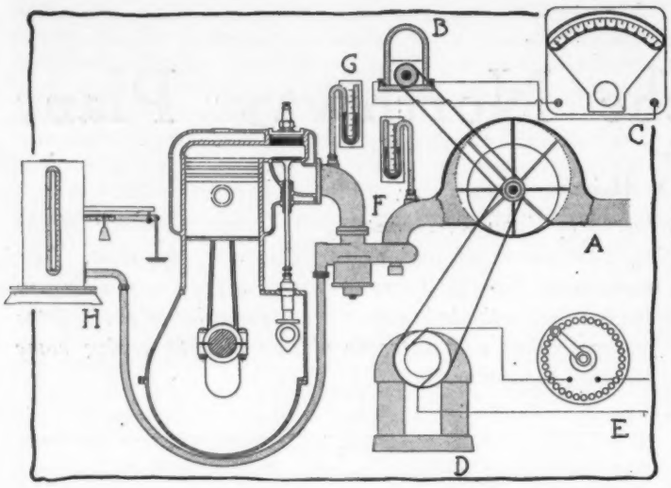

Fig. 2—Method of applying air meter to carbureter for testing purposes

that the test was made. Of course he can put the date of the test for the benefit of the society. At E I have indicated what I believe should be taken into consideration on the day the test is made. It contains the specific gravity of the gasoline, the temperature of the same, the temperature of the room, the temperature of the circulating water, the barometer and the relative humidity. At F is recorded the model, number of the models and the bore and stroke, whether it is four-cylinder or six-cylinder, and whether it is a sliding-valve or poppet-valve motor. At G is recorded the kind of dynamometer, whether it is a water brake or an electric and who is the maker of same. At H is shown the make and type of carbureter used, also the kind of magneto and spark-plugs.

Now it may seem advisable that we also should give the weight of the motor, the weight of the pistons and connecting rods, as well as the amount of offset of the cylinders from the center line of the crankshaft, or, perhaps, give other items which you think are of importance.

At I is given the name of the engineer who made the test. If he has an assistant, the assistant's name should also be given at J.

Calculating Horsepower

Below is the sectional paper. The figures at K give the brake horsepower, also pounds pull on a brake beam of 63 inches radius. It is shown here reading from 1 to 50 horsepower. However, it might be advisable to make this scale show from 1 to 100 horsepower. It is also necessary to give the length of the brake beam in inches from center of shaft. If we use a 63-inch brake beam, which is the size I use, the pounds pull at the same time indicates the horsepower by simply multiplying pounds pull times speed and by placing a decimal after the first three figures, which are fractions of a horsepower.

It might also be advisable to show at K the horsepower output for 1 cubic inch of piston displacement, so that we not only have the total horsepower but the horsepower output per cubic inch of piston displacement.

At L are the revolutions from 200 to 2,000, but it might be advisable to show it read to 3,000 revolutions. On scale M are the piston speeds per minute in feet.

I have plotted six curves of a Northway four-cylinder 4.125 inches bore and 4.75 inches stroke motor. The curve N gives the brake horsepower at different speeds; curve O gives the volumetric air consumption in cubic feet per minute without the carbureter; and curve P the air consumption in cubic feet per minute with the carbureter. Curve Q shows total gasoline consumption in pounds per hour. Curve U gives the gasoline consumption per pound per horsepower-hour and is the gasoline efficiency of the motor.

The object of plotting air curves is to know the volumetric efficiency of an engine in order to give the engineer an opportunity to determine from this curve whether his valve timing, size and lift are correct for the highest efficiency, and measuring the air consumption without the carbureter and with the carbureter, the difference gives the air losses due to the carbureter.

The volumetric efficiency of the engine charted here has depreciated very nearly 10 per cent., due to the use of the carbureter. You might say that is of no importance, but it is if you are measuring different carbureters. If you can get a carbureter that does not depreciate the volumetric efficiency of the engine it naturally produces a greater horsepower output. On the other hand, the gasoline consumption test is for the purpose of determining the carbureter efficiencies, and by comparing the cubic feet of air consumption in relation to the quantity of gasoline consumed in a given time tells us the relation of gasoline to air at different speeds and torques. If I adjust the carbureter

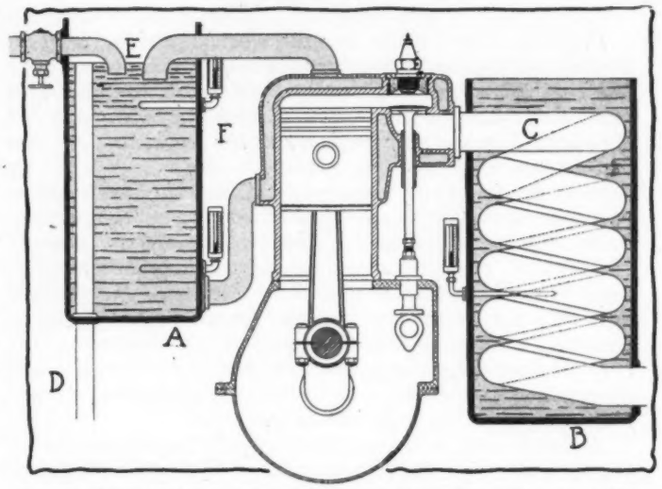

Fig. 3—Apparatus for determining heat losses in water circulation system

to maximum efficiency at 400 revolutions and now speed up the engine to 2,000, and if the relative rate of mixture has varied so that there is a greater percentage of air to gas as compared to the lower speed, this then will tell us that this carbureter is not accurately mixing the gas and air for the different speeds in the proper proportions. What we are trying to do is to select a carbureter which gives that same relative rate of mixture at low and high speeds. Unless we plot air and gasoline curves we cannot very well determine the relation accurately. It therefore seems that it is essential to know what our air efficiency is in comparison to our gasoline efficiency. It is also advisable to show the mechanical losses in the engine; this will tell us whether our connecting-rods and pistons are too heavy or if there is an excessive piston or bearing pressure, and show also in which direction we should proceed along the line of experimentation to make improvements.

Most Efficient Cam Design

By plotting air curves and changing the shape of cams and varying the valve lift, the cam which makes possible the greatest air consumption will produce the greatest horsepower output in the motor.

At the Northway plant we have an experimental engine in which there is a sliding camshaft having a cam on same which is pointed on one end and very broad on the other end. If now by the air meter we measure the cubic feet of air consumed per minute, and move the cam to and fro, and note the indicator of the air meter rise and fall, whatever position of the cam the engine consumes the greatest amount of air determines the proper shape of the cam for maximum power at the particular speed of motor desired. Therefore, you see, to measure the air is one of the processes which it is necessary to consider to get the

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maximum horsepower output in our motor. We must, however, take into consideration what that engine is supposed to do. Is it for racing purposes and we want to get the greatest possible power out of the engine regardless of speed, or do we desire to build a motor producing the greatest power at 1,000 feet piston speed? What we are striving to do is to determine the proper shape of cam for different revolutions to produce maximum power, so you see volumetric efficiency must be taken into consideration when making engine tests.

Air Meter on Carbureter

At the Northway plant I constructed an air meter, Fig. 2 A, which was calibrated so that every revolution represented a certain volume of air. It consists simply of a drum 10 inches in diameter and 10 inches long with vanes that move in and out. The drum rotates on ball bearings; the air passes through this air meter and on through the carbureter. The revolutions of the drum are recorded by a Weston magneto tachometer, B. The scale C of the Weston instrument, which ordinarily reads revolutions, is graduated to read cubic feet of air. The engine is driven by the electric dynamometer when using the air meter. It is necessary to drive the air meter by a small electric motor D, the speed of which is regulated by a rheostat E. If a motor was not used, naturally there would be some lag in the speed of the drum of the air meter due to suction which would introduce an error. I have inserted in the air pipe between air meter and carbureter a small U-shaped liquid pressure gauge F; if there is any variation of pressure one column of the liquid will be higher than the other. The speed of the air meter should be so regulated that both columns are of the same height. I also use a similar U-shaped pressure indicator G inserted in the intake pipe between the carbureter and the cylinders.

H is a copper tank containing 10 gallons of gasoline, provided

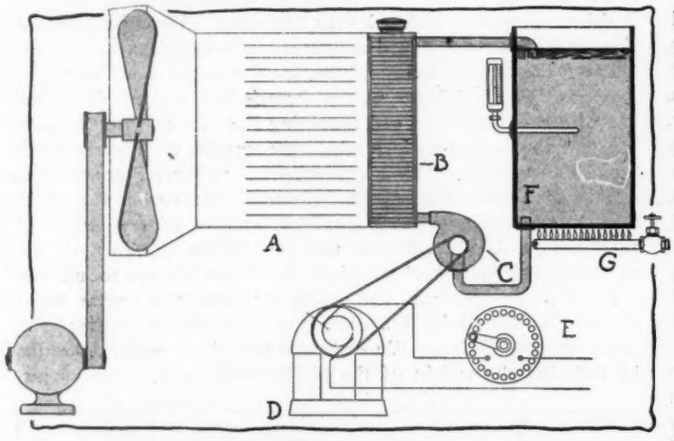

Fig. 4—Method of determining correct size of radiator for given engine

with a gauge glass graduated in pints. This tank rests on platform scales so that the gasoline can be weighed. If I run the engine 300 or 400 revolutions for 5 minutes, measure the air in cubic feet, weigh the gasoline in pounds, then run the engine at 1,000 revolutions the difference in the quantity between air and gas at different revolutions determines the carbureter efficiency. It is advisable to always resort to the same instruments to get accurate comparisons. By these measurements I can quickly determine which is the best carbureter.

Other engineers may resort to different methods to get the same results. Some use a venturi tube to measure air consumption and by calculus determine the quantity, whereas by this air meter you get direct readings and eliminate figuring. This is a very simple method of getting air and gasoline readings in order to determine carbureter efficiency.

When I run the engine under power and plot air curves the air efficiency due to running the engine under power, and then afterwards run it by the dynamometer, the difference between the air consumption when the motor is running under power and getting the action of the back-pressure as compared with the same engine running without the firing conditions gives the losses that are produced by the back pressure in the cylinder. I can check up readings in that way and know whether the back-pressure due to the muffler produced undue volumetric losses and consequent loss of power.

In connection with engine tests we naturally also want to know what our heat losses are, due to loss of water circulation and exhaust gases. Fig. 3 shows the arrangement of apparatus, which consists of a tank A, which is of a certain size and contains 500 pounds of water. The water from the engine circulates through this tank. On the exhaust side is another tank, B, which also contains 500 pounds of water, and through which circulates a coil of copper tubing C of such length and size that when the exhaust gases finally pass out through the end of the coil the gas is at atmospheric temperature, or nearly so.

Radiator Size Determined

If the motor is run under power at 40 horsepower and has 500 pounds of water in the cooling system at atmospheric temperature, then by recording the degrees rise in temperature of the water, and also the time in minutes, I can quickly tell the heat losses due to the water circulation. The exhaust gas heat losses are similarly measured by water absorbing the heat. In order to maintain a constant temperature there is an overflow pipe E and cold water inlet, and thermometers F indicate the temperature of the water at the inlet as well as the outlet from the motor. By this method I can determine accurately that a motor running at 1,000 revolutions per minute and developing 30 or 40 horsepower produces so many heat units in the water circulation and exhaust.

If we consult a radiator maker using the above method of test he would proceed as follows: He would first connect the 500-pound tank of water to the pump which the automobile manufacturer will send him, and which is for use on that particular motor, and rotate the pump at a certain speed. Then after heating the water up to a certain temperature he would put the radiator inside of a box in which air could be forced through the radiator at a known number of feet per minute, constituting an artificial air draft the same as the car meets on the road. By measuring the velocity of the air by an anemometer at a certain number of inches per hour, it follows if we draw the heat out of the 500 pounds of water in the tank in the same time that it took the engine to produce it, that this would determine the proper size radiator to use in connection with an engine of a particular size.

At the present time what do we do? We go to the radiator manufacturer and say: "I have a 40-horsepower engine. I

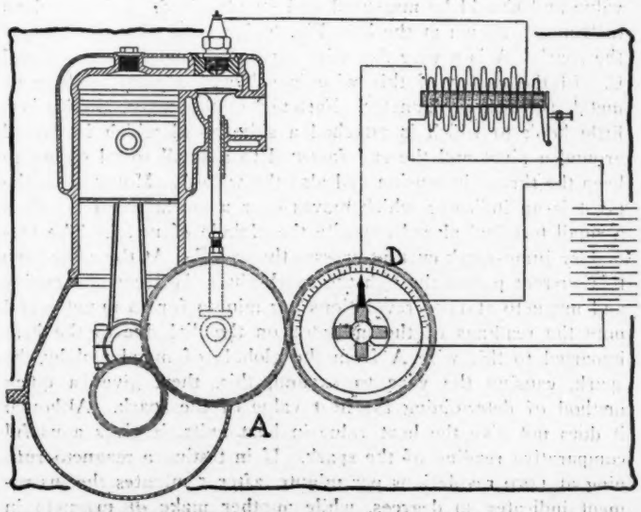

Fig. 5—Device for showing exact position of spark in relation to piston

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want you to give me a radiator." From some experience he has had in the past the maker will say, "I think this radiator will be satisfactory." You put it on the car and later find out it is too small because the water gets excessively hot. If you select the radiator in the winter and it gives the best results it then is too small for the summer. If it is correct for the hottest days in the summer then it is altogether too large for the winter. Because of this, we should make our radiator determination by some similar empirical method and adopt some standard volume of water for comparison; it may be 500 pounds or 1,000. I have adopted 500 pounds because I find in the practical testing of engines of different sizes this figure was entirely satisfactory and gave accurate results.

Fig. 4 shows the radiator test apparatus, in which A is a box with a fan at one end of it. The radiator B is placed at the other end of the box inclosing it. C is the water pump. The water pump is driven at engine speed by a small motor D controlled by a rheostat E. F is a tank which contains 500 pounds of water. This water is heated by a gas burner G to a certain degree. *Then air is forced through the radiator at a known velocity and note made of the time that it takes the radiator to pull the heat out of the water. If the water cools off at the same rate that the engine heated it up, the radiator is correct in size. This, then, is a method of determining the proper size of radiator for a given size engine.*

Fig. 5 A shows an instrument of importance in testing, in order to eliminate all possibility of errors being introduced by variations of ignition. It consists of a graduated metal dial D in the center of which a pointer is rotated by the camshaft at camshaft speed. The secondary spark jumps from the end of the pointer to the dial. The pointer is set in relation to position of piston so that when it stands at zero the piston is on upper dead center, or maximum point of compression. The high-tension current passing through spark-plug also passes from the pointer to the dial simultaneously so that one can determine accurately when the secondary spark takes place in relation to the piston. It seems advisable that we should eliminate the breaker box timing and go by the secondary spark entirely. If the breaker box on the magneto is now advanced or retarded the secondary spark will indicate on the dial the amount of advance or retard of the firing point of the ignition. If we make carbureter tests from day to day we want to know definitely the position of the spark in relation to the piston.

Heat of Spark To Be Constant

The other element which enters into consideration is the heat of the spark. It is not absolutely necessary to know accurately what the real heat value of the spark is in heat units, but the spark which we get from day to day should be of the same heat value and should be measured and standardized. I designed an instrument, shown at the left, Fig. 6, for measuring the heat of the spark. A is a very fine wire supported on two posts, B and C. In the center of this wire is soldered a small globule of metal, 1-8 inch in diameter. Fastened to this metal globule is a little hook to which is attached a silk thread which is wound around a pivot and the end fastened to a small spiral spring to keep the thread in tension and also the wire A. Mounted on the pivot is an indicator which moves over a graduated dial. D is a small terminal placed opposite the globule of metal. The secondary jump-spark current crosses the gap E. At the same time this current passes through the spark-plug. If I run the engine and magneto at 1,000 revolutions per minute for 10 minutes and note the readings of the indicator on the dial due to the heat imparted to this wire A from the globule of metal and by the spark, causing the wire to expand, this, then, gives a quick method of determining the heat value of the spark. Although it does not give the heat value in heat units, it gives a useful comparative reading of the spark. If in testing a magneto running at 1,000 revolutions per minute, after 5 minutes the instrument indicates 40 degrees, while another make of magneto in 5 minutes produces only a 20-degree deflection, then the heat

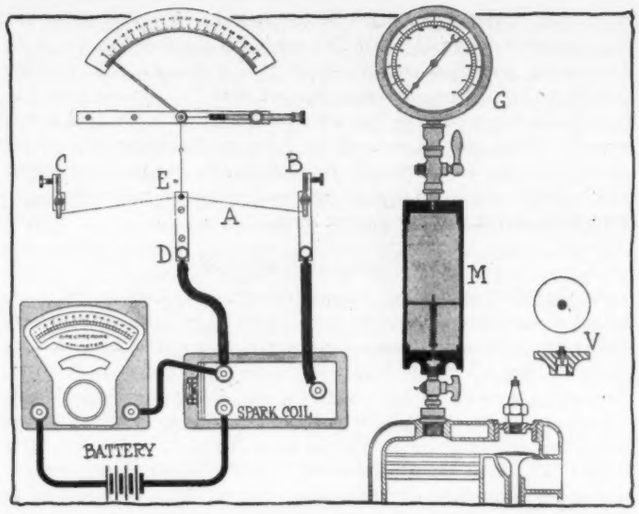

Fig. 6—Instruments for measuring heat of spark and cylinder compression

value of the spark of the magneto which produces only 20 degrees is only one-half as much as the one which produced 40 degrees.

If I am testing an engine today on 20 degrees ignition value and tomorrow on 40 and do not know it and get different results I am then liable to credit the results to conditions which do not exist and thereby introduce errors which should be eliminated. We must standardize the heat of our spark as well as spark setting.

Fig. 7 shows a device for measuring carbureter acceleration and is a means of determining rate of throttle opening. A drum A drives a fan B in which the fan blades are adjustable. Around the drum is wound a cord supporting a weight D. Connection between the throttle lever and the drum is made as shown in the diagram. The weight opens the throttle by the cord, drum and fan at a certain rate. By determining the rate of throttle opening and the increase of speed of the engine at different loads from a certain speed to a higher speed, carbureter acceleration can be accurately determined. Naturally the carbureter which accelerates the engine to the greatest number of revolutions in the quickest time determines the acceleration qualities of that particular carburter, and therefore is the one that we should use.

Fig. 8 shows apparatus and means for measuring engine vibrations. As is well known, that is a very serious matter with many engine builders. We endeavor to reduce engine vibration by reducing the weight of the reciprocating parts, such as pis-

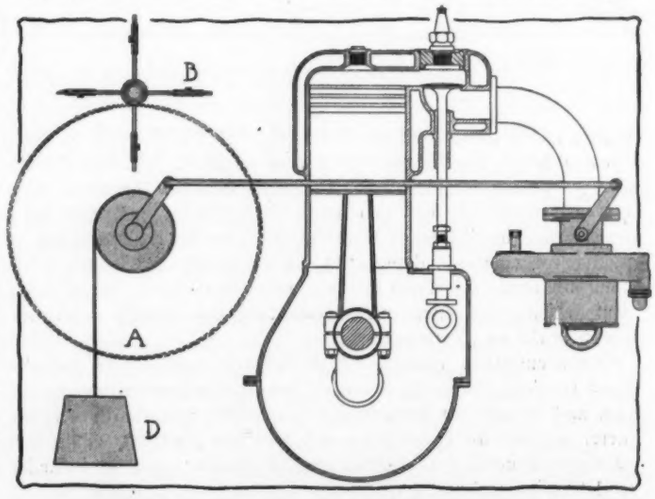

Fig. 7—Fan governor applied to throttle lever for determining acceleration properties of carbureter

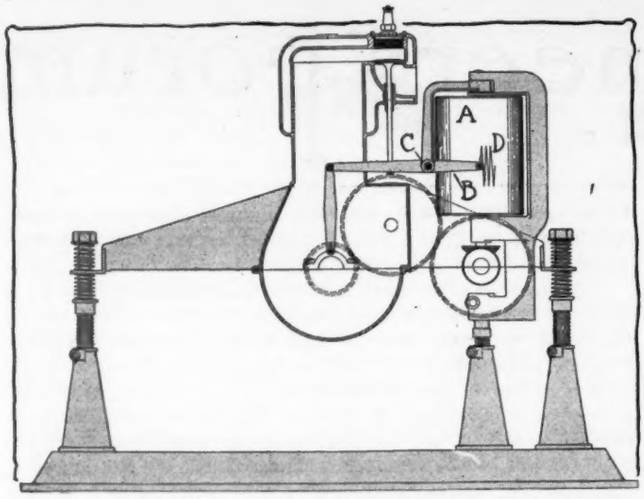

Fig. 8—Apparatus for measuring engine vibration and determining range of synchronous speeds

tons and connecting-rods, and also by balancing the crankshaft and flywheel. I found in practice that the maximum vibration is not altogether due to the weight and movement of the reciprocating parts, as will be shown later on after having described the apparatus used.

The drum A, Fig. 8, is rotatively mounted on a column rigidly held to a base plate. Secured to the engine cylinder is the indicating arm B which is pivoted at C. The end of this arm carries a pencil which marks on the paper at D on drum. If we run the engine by a separate source of power at different speeds we get a certain amplitude of vibration, and when we operate the engine under its own power we get an entirely different vibration having certain peculiar characteristics showing excessive vibration between 1,000 and 1,400 revolutions and minimum vibration below 1,000 and above 1,400, indicating that a sort of synchronism takes place at a certain speed, where power developed and weight of engine are such as to produce harmonious oscillations of great amplitude.

Naturally the automobile manufacturer who designs the car and the engine does not want this excessive vibration to take place at the normal running speed of the engine, say, 20 to 30 miles an hour. He would like to have this excessive vibration take place at a speed at which the car does not ordinarily run, say, at 40 or 50 miles an hour.

Fig. 9 shows apparatus designed along the lines of the Hospitalier Carpentier manograph excepting that I resort to a rotating drum D making one revolution for two revolutions

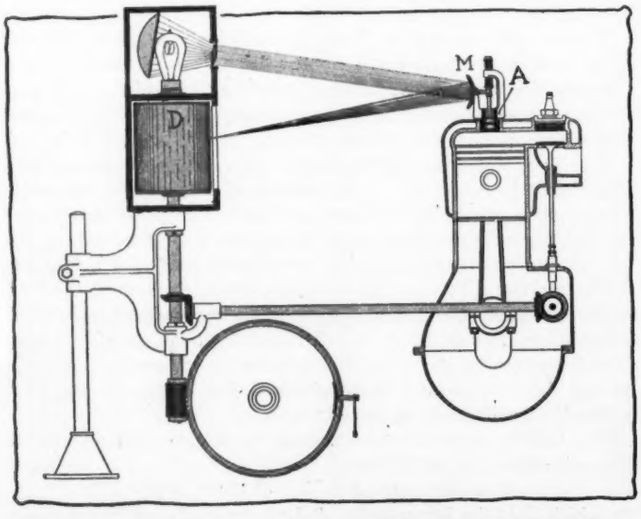

Fig. 9—Manograph for obtaining cylinder pressure diagrams

of the crankshaft. Around the drum is wound a sensitized film. Upon this film is photographed by a beam of light from the mirror M operated by a small piston in cylinder A a line, which line indicates the pressure variation in the combustion chamber of the gas engine cylinder during its four cycles and at various speeds.

A device which I use for measuring cylinder compression is shown at the right, Fig. 6. M is a chamber of fairly good size, having a valve V, so that as the engine runs the indicator on the pressure gauge G does not bob up and down, but goes up gradually. Now we can get the compression, hot or cold, of the different cylinders by this instrument. There are, no doubt, many other ways to measure cylinder compression; this is simply one way to do it.

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Requirements in Leaf Spring Design

¶ *From a paper read before the Society of Automobile Engineers by Leavitt J. Lane.*

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In the design of spring leaves there are several important factors to be considered. Each leaf should be so tapered from the center outward that strains set up when the springs are in action may be distributed gradually. In the same manner the leaves taken collectively should have the same resulting taper, that is, the bottom or top leaf, as the case may be, should be the longer, each succeeding leaf being shorter in length so that under load the whole spring will approximate a true arc. In goving over a rough road, springs are subjected to considerable side-sway. To take care of this it is advisable to have some means of preserving alignment. Various methods are available. Near the end of each leaf there may be cut a slot into which projects a bead from the leaf underneath; or at the same point there may be formed a rib having a longitudinal movement in the indentation formed by the making of a rib in the leaf above. These ribs and slots should be so placed that each is covered by the next leaf above, resulting in their being out of sight and free from dirt. There is a little difference in the comparative value of the shape of the leaf points. The round bevel end is in most common use. Springs more than 2 inches wide should not have French or diamond points, as they entail unnecessary waste. In most cases the long leaf supporting the master leaf should have square points, especially with a high cambered spring, in the case of which the torsional strain on the master leaf is considerable. As a means of holding graphite or other spring leaf lubricant the leaves may be slightly concaved on both the top and bottom, and the space between filled with the lubricant to prevent rusting of the parts and to add to the wearing quality of the spring by decreasing friction.

The best results of spring suspension can be determined by experimentation only. The front end of the front spring must be anchored securely to the frame, as it takes the forward thrust load. The rear end may be allowed more or less play by means of a suitably designed shackle. The spring may lie in a horizontal plane or be somewhat inclined. In some cases raising the spring slightly at the forward end adds considerably to the riding qualities. The front end eye-bolt must be of such strength as to take care of the bearing load as well as the forward thrust load. It is imperative that this bolt be made of a steel of good anti-fatigue qualities. The front left-hand spring should be so designed in respect to strength that it will properly take care of the downward thrust induced by the torque developed in the motor, which revolves in a clockwise direction according to the general practice. This torque rarely exceeds 150 pounds, but it is necessary to make a trial for accuracy. The suspension of the rear spring depends to a great extent on the design of the chassis distribution of load, etc. If the spring takes the driving effort, the front eye-bolt must be designed to this end. At the present time about 50 per cent. of the American cars are driven in this manner.

Horsepower As Basis For Tax Discussed

Part II.

Prominent Automobile Engineers Vary in Their Opinions as to the Relative Value of Formulae

Farr Opposed to Changing S. A. E. Rating
Planche Thinks A. L. A. M. Formula Inadequate
Should Rate the Average Motor, Says Holmes
Brake Test Unfair, Says Granquist
Should Be Taxed for Capacity, Says Heising
S. A. E. Rating Should Be Retained, Claims Mixer

THAT the article entitled "Cars Taxed on Unused Horsepower, which appeared in THE AUTOMOBILE for March 27, was timely is borne out by the widely divergent opinions expressed by the leading automobile engineers of the country. Some of these views on the subject are given herewith:

INDIANAPOLIS, IND.—Editor THE AUTOMOBILE:—I am very much opposed to any change in the present S. A. E. rating, as I believe that this is about as good as any other simple formula which could be devised, and also we think it would be rather confusing to adopt any other at present. Also the fact remains that if this should be changed, it should be to reduce the resulting horsepower instead of increasing it, as very few engines come up to the S. A. E. rated horsepower from the formula $\frac{D^2 \times N}{2.5}$ at the average speed at which cars are run. We do not believe that this average speed exceeds 20 miles an hour.

As an illustration of this point, the National company has spent considerable time in developing the maximum horsepower of its engines, and at the rate of 20 miles an hour (cars geared on an average of 3 to 1, which would be turning the engine over at about 560 revolutions per minute) our engines develop about 32 horsepower under steady pull.

According to the S. A. E. formula, this engine, which is four-cylinder 4⅞ by 6, is rated at 38 horsepower, so you see that at 20 miles an hour on the road there is quite a wide margin between the actual horsepower and the S. A. E. rating. Of course we realize that at much higher speeds on the road the horsepower does come up very materially. For instance, at 90 miles an hour, at which our cars have been known to run, this engine develops about 110 horsepower. As there is no possibility of a car running anything like this fact on an ordinary highway, and as the speed limit in quite a number of states is 20 miles an hour, and in cities much less, we do not believe that this maximum speed should have any bearing on the case.

It must be borne in mind that even with the best transmission there is considerable loss in power from the engine to the wheels, and we do not wish to be taxed for power we cannot use under average conditions.

In objecting to any change in the S. A. E. rating for state taxation, I do not mean to leave the impression that I am at all opposed to higher taxes on automobiles, provided these taxes are used for the benefit of the motoring public. We do, however, object to any discrimination against the motor car and the use of these funds for other purposes than good roads and in other ways which are of service to the motorist.—WILLIAM G. WALL, National Motor Vehicle Co.

SPRINGFIELD, MASS.—Editor THE AUTOMOBILE:—It is my remembrance that at the discussion on the question of adoption of the Royal Automobile Club's formula by the Mechanical Branch of the Associated Automobile Manufacturers, while nearly all tests of American-made motors at that time showed to more or less degree a considerable increase over the ratings given by this formula that it was the consensus of opinion of engineers present at those meetings that motors in general after being run a year by the average customer would not show on a test bench in excess of this formula, and it is the writer's opinion that the average car will not at this day.

I have made several tests of our motors which were the general run of our output and have found that they run considerably over this, in fact, checked up approximately with the formula that the writer has used for a number of years. This formula is the total cubic displacement of the motor divided by 8. We have made several tests of motors here which have checked with this almost exactly and also have had one test made by the Massachusetts Institute of Technology which showed the same results. We believe that if another formula is to be adopted, it should not give a rating higher than that mentioned above.

Our model S is a 6-cylinder motor, 5-inch bore by a 5.5-inch stroke rates by S. A. E. rating, 60 horsepower, by the writer's formula, 80.99 and the Incorporated Institution of Automobile Engineers, 108.88 horsepower.—H. G. FARR, M.E.—Knox Automobile Co.

DETROIT, MICH.—Editor THE AUTOMOBILE:—A great deal has been said, a great deal has been written on the question of a formula for horsepower rating of gas engines, and it seems that no one can agree on that question. However, the question is, and has always been a very simple one.

The formulas given by the Royal Automobile Club of England and the A. L. A. M. were never anything but incorrect formulas. No engineer would try to figure out the power of a steam engine in figuring only on the bore of the cylinders without taking the stroke into consideration. Yet, for several years the public has been deceived with so-called formulas taking in account the bore only, not even mentioning the speed of the motor; and really long before the A. L. A. M. formula or the R. A. C. formula had been created, there existed a correct and accurate formula giving the exact power to be obtained from a gas engine of a given bore and stroke at variable speeds.

We have reference to the Hospitalier Ringelmann and Witze formula, which is as follows:

$$P = \text{Horsepower} = K \times d^2 \times l \times N \times n$$

in which P is the horsepower, d the bore of the cylinders, l the stroke, N number of revolutions per minute, n the number of cyl-

inders of the motor, K a variable co-efficient, which we might call the efficiency co-efficient, varying with the design of the motor, the number of cylinders, the quality of the workmanship, the degree of perfection of the balance of the motor, in short, a co-efficient which can express the exact relation between the efficiency of different types of motors.

This co-efficient has a value well-defined for the maximum power of a given motor of one, two, three, four, six or eight cylinders, and it will be found as the number of cylinders increases in the motor, K decreases steadily for the same power on account of increased frictions and losses of calories.

It is well to state too, that, as the bore of a motor increases, for the same number of cylinders, K increases too, for if the power increases proportionately with the square of the diameter, the losses through friction and dissipation of heat units increase only proportionately to the diameter up to a certain limit.

This may seem a little complicated to the layman, but in the end a pretty fair idea of the power expected may be figured for the average size motor used in automobile construction. The bore and stroke are given in meters. We shall give the following values to K:

One cylinder	K—5.25	Four cylinder	K—4.58
Two "	K—4.90	Six "	K—4.13

To give an example let us take the Chevrolet six motor which has a bore of 3 9-16 inches and a stroke of 5 inches, or in meters 0.0905 bore, and 0.127 stroke. The formula will give us at 1,950 revolutions per minute:

$$P = 4.13 \times \frac{2}{0.0905} \times 0.127 \times 1950 \times 6 = 50.25$$

which is the power maximum shown by inspecting the curve of the Chevrolet motor. A value of K can be obtained easily to apply on bore and stroke given in inches it has only a great many decimals, being of a very low value.

The average owner of a car uses only the maximum power of his motor on exceedingly infrequent occasions, he generally drives his car on high gear at a speed in the neighborhood of 20 to 25 miles an hour, which corresponds to a speed of 750 to 1,000 revolutions of his motor. This is mostly what he uses every day to drive his car. If we apply our formula to the Chevrolet motor, we find that the power at 1,000 revolutions is

$$P = 4.13 \times \frac{2}{0.0905} \times 0.127 \times 1000 \times 6 = \text{about } 26 \text{ horsepower.}$$

If we compare with the A. L. A. M. formula we find that it gives a power of 30.6 horsepower for our motor, therefore our average owner is not even using all the power allotted to him by this dear A. L. A. M. formula and should not be taxed any higher, for it certainly would be an abuse of power (both ways).—E. PLANCHE, Chevrolet Motor Co.

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SYRACUSE, N. Y.—Editor THE AUTOMOBILE:—I believe the present rating should be corrected to take into account the different strokes of the different motors now being made. The rating which should be adopted should be a conservative one, one that the average motor will meet, and not a rating that represents the best motor, keyed up to the very highest condition. This would really be the rating that the average motor would come up to that is in the service of the owner.—A. HOLMES, H. H. Franklin Mfg. Co.

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NEW BRUNSWICK, N. J.—Editor THE AUTOMOBILE:—Regarding the growing sentiment among our secretaries of state toward adopting new methods of taxation of automobiles according to horsepower and abolishing the present S. A. E. or A. L. A. M. ratings, it seems to us that this tendency is not in the right direction, for the following reasons:

In the first place, the speed at which an automobile may be driven over the highways is fixed by law. Secondly, the power necessary to drive any machine at this speed depends upon the weight and consequent resistance of that machine.

This power may be the full capacity of a small motor or a small portion of that of a large motor. In other words, it requires a certain power to do a given work, regardless absolutely of the size or nature of the power plant. Incidentally it seems to us that any taxation according to horsepower alone is fallacious.

Horsepower taxation according to the S. A. E. or A. L. A. M. formula is fair to all makers alike, while systems based on brake tests or cylinder capacity would be distinctly unfair, as they would put the burden of heavier taxes on makers of more efficient motors in the first case, and on makers of larger ones in the second. Since it is a fact that the large motor is more durable than the small, due to its operating at a lower average speed and frequency, these other systems of taxation would militate against motors superior either in efficiency alone, or in long life also, and would place a premium upon inefficient and undesirable motors, thus working out as highly unsatisfactory to the progress of the art, the owner, and the trade in general.—G. E. GRANQUIST, Simplex Automobile Co.

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ST. LOUIS, MO.—Editor THE AUTOMOBILE:—Very few of the average car owners and chauffeurs are able to keep their motors in such shape as to develop the full horsepower, according to the factory rating, and which was no doubt obtained at the factory under the very best conditions. This is easily proven when a car is brought up to the factory to be tuned up and a noticeable difference in power occurs after one of the factory experts has worked on it a short time. I believe that the A. L. A. M. rating is entirely adequate for the power obtained in general use.

It occurred to me that it might be more fair to the automobile owner to tax their cars according to their capacity, instead of the actual horsepower or a combination of the two. For instance, a man using a 40-horsepower, two-passenger car should not pay as much as a man using a 40-horsepower, seven-passenger car, any more than the man with a 5-ton truck with a 30-horsepower motor in it should pay less than a man with a 3-ton truck with a 40-horsepower motor.

The subject, we believe, is one of great interest, and there are numerous little points upon which sound arguments could be based. The writer is of the opinion that the article you have in mind will be one of great interest throughout the country, both to manufacturers and car owners.—GEORGE F. HEISING, Moon Motor Car Co.

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RACINE, WIS.—Editor THE AUTOMOBILE:—I wish to express the following views in regard to S. A. E. formula for horsepower rating:

I realize that from a selling standpoint S. A. E. rating is not all that it should be, being based on bore alone it does not give the sales agent the necessary leeway to specify the horsepower, taking into account the different strokes which might be used with this same bore. However, from the manufacturer's standpoint and from the consumer's standpoint I feel that the S. A. E. horsepower rating is a fair rating for operation of the car on the road. I do not figure that we get much more out of our motors with the average driver using them on the road than S. A. E. formula allows them. On block test, however, this runs up from 50 to 60 per cent. more at times. I would therefore suggest that the S. A. E. rating be retained as it is practically the only fair rating which has been suggested up to the present time.—W. G. MIXER, J. I. Case Threshing Machine Co.

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WILKES-BARRE, PA.—Editor THE AUTOMOBILE:—I believe that a more equitable method of taxation would be one based upon the piston displacement of the motor rather than upon the A. L. A. M., or S. A. E., formula. It is well known that neither of these formulas take account of the high piston speed and consequent increased horsepower developed by the latest type of motors.—A. M. DEAN, Matheson Automobile Co.

Light Delivery Cost

Record System and Cost Figures Obtained by Its Use by South Bend Owners

By Proper Economy, Packages May Be Delivered at Average Cost of 1.63 Cents

ONE of the fields in which the exception ought to be the rule is in the application of system to small truck fleets. In other words, among the thousands of companies and individual owners employing one or a few small commercial vehicles there is only an exceedingly small percentage which keeps operating records in scch a manner that actual benefits may be derived therefrom. To produce such records which may serve as a basis for operating cost reduction, it is necessary that the forms used for recording the data are so designed as to permit the entries of all facts bearing any relation to operating cost.

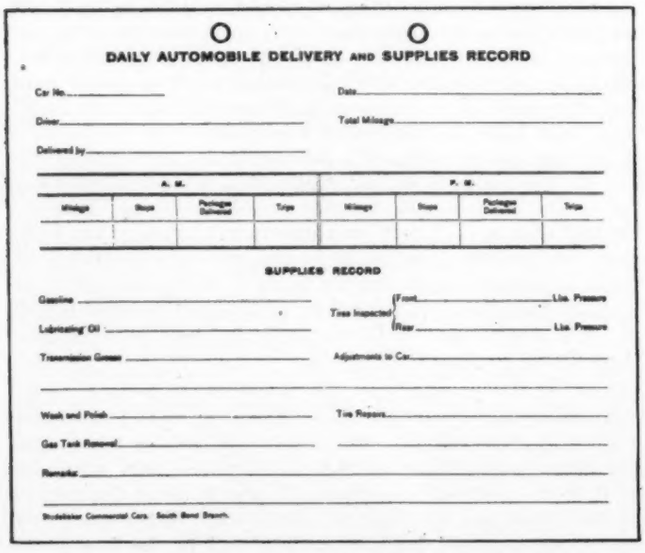
Below are described and illustrated three forms designed by the Studebaker Corp., South Bend, Ind., for the benefit of users of Studebaker 20 delivery cars. A few instances of the results obtained by records kept on these forms are also given.

The basis of the entire record system is a daily delivery and supply record, Fig. 1. This form is 8.5 by 7.25 inches, printed on thin tan cardboard and affording space for recording the mileage traveled by the car, the number of stops made, the number of packages delivered and the number of trips for both morning and afternoon of a day. The total mileage made during the day is recorded at the top of the blank, as are the company's number of the car, the name of the driver and that of the helper delivering the goods to the customers. Below the work record, the supplies used during the day are noted. These records include the quantities of gasoline, lubricating oil, transmission grease and what material is used for washing and polishing the car or any parts thereof. A record is made of the pressure maintained in the tires during the day, of adjustments made on the car and of tire repairs. When the statement has been filled out, it is signed with the driver's and his helper's initials and is turned over to the delivery superintendent.

At the end of the month the information recorded on all the daily cards pertaining to one car is summed up on a monthly operating expense record, Figs. 2 and 3. This form is 8.5 by 13 inches and printed with black ink on fairly heavy white paper. Fig. 2 shows the front of the blank, on which the type capacity and model of the car and the date on which the monthly record is filled out are entered; the same applies to the name of the owner and his address as well as the car number used by the company and the name of the driver. The rest of the front page is filled out by the spaces for copying the daily records of mileage, number of stops, packages delivered, fuel, oil and transmission grease used, as well as incidental expenses and remarks. One line is provided for each of the 31 days of the month and the last line serves for footing the totals.

Fig. 3 shows the reverse side of the blank giving the monthly totals of the various items appearing on Fig. 1. It also affords space for recording the average number of deliveries per day, miles per day, miles per gallon and gallons per day.

With reference to these three blanks, the following should be noted. The daily record card blank is not always filled out completely, but in many cases only the mileage, the gasoline and the oil consumption are given. Of course, it is better to also make out complete delivery records as they will help the owner to decide what the truck is worth to him. Anyway, the Studebaker Corp. supplies these blanks principally to companies who have



DAILY AUTOMOBILE DELIVERY AND SUPPLIES RECORD

Car No. _____ Date _____

Driver _____ Total Mileage _____

Delivered by _____

A. M.				P. M.			
Mileage	Stops	Packages Delivered	Trips	Mileage	Stops	Packages Delivered	Trips

SUPPLIES RECORD

Gasoline _____ Tires Inspected (Front _____ Lbs. Pressure; Rear _____ Lbs. Pressure)

Lubricating Oil _____

Transmission Grease _____ Adjustments to Car _____

Wash and Polish _____ Tire Repairs _____

Gas Tank Removed _____

Remarks _____

Studebaker Commercial Cars, South Bend Branch.

Fig. 1—Daily record blanks for Studebaker wagons

OPERATING EXPENSE RECORD
of
STUDEBAKER 20 PANEL DELIVERY CAR

For Month of August — Date Report Received, Sept. 14, 1912
Owner, Jos. Grueger & Son — Business, Grocer
Address, No. 704 E. Sample St., South Bend, Ind.

Number		Price		Total
42	gallons gasoline at	$.14½	per gallon	$6.09
2	gallons lub. oil at	.40	per gallon	.80
2	pounds trans. grease at	.33	per pound	.66
	Tire repair			None
	Repairs to car			None
	Incidentals for car			None
				$7.55
Total mileage, 480. Average miles per gallon, 11½. Cost per mile.				.01 1-2
Total days' service, 30. Average miles per day, 16. Cost per day				.25 5-6
Approximate deliveries per day, 70. Cost each				.00 1-3

FIXED EXPENSE

Interest on $800 at 6% per year, $48. Per month	$4.00
Depreciation on $800 at 20% per year, $160. Per month	13.33
One new set tires (cases and tubes), year, $90. Per month	7.50
Insurance (value $600), per year, $16.50. Per month	1.37
License and tax per year, $6. Per month	.50
Driver's salary. Per month	60.00
Garaging of car. Per month	.....
	$86.70
Grand total expense for one month's operation, including supplies and fixed expense	$94.25

RECORD OF DEMONSTRATION OF

To a South Bend Grocer — Saturday, Oct. 5, 1912

SUMMARY OF TRIP TOTALS

Trip A.M.	Stops	Mileage	Packages Delivered	Time Running	Time Stopped While Delivering	Time Consumed in Loading
1	3	1.09	3	23 M.	12 M.	
2	9	1.05	10	21 M.	11 M.	5 M.
3	14	3.01	15	37 M.	20 ½ M.	28 M.
4	17	5.01	17	40 M.	14½ M.	20 M.
5	1	1.00	1	4 M.	1 M.	3½ M.
6	2	1.03	2	8 M.	2 M.	1½ M.
7	1	3.02		10 M.		Driver to lunch
Total P.M.	47	17.00	46	2 H. 23 M.	61 M.	57 M.
1	15	4.07	15	53 M.	16½ M.	
2	14	4.00	15	43 M.	17 M.	13 M.
3	16	5.04	16	55 M.	15 M.	7 M.
4	6	5.00	7	34 M.	7½ M.	8 M.
5	5	5.03	5	35 M.	6 M.	3 M.
	47	24.04	58	3 H. 40 M.	62 M.	31½ M.

GRAND TOTAL A.M. AND P.M. DELIVERIES

12 trips.
33.04 miles covered.
103 stops.
107 packages delivered.
6 hours 3 minutes actual running time (motor running continually from time of start till return to store).
2 hours 3 minutes time stopped (motor running while making deliveries).
1 hour 28 minutes time loading and waiting for orders to be put up.

OPERATING EXPENSE RECORD
of
STUDEBAKER 20 PANEL DELIVERY CAR

For Month of August — Date Report Received Sept. 5, 1912
Owner, J. Bergsted, — Business, Grocer
Address, 1402 Kemble Avenue, South Bend, Ind.

Number	Price		Total
34 gallons gasoline at	$.14½	per gallon	$4.93
3 gallons lub. oil at	.36	per gallon	1.08
1 pound trans. grease at	.33	per pound	.33
Tire repair			None
Repairs to car			None
Incidentals for car			None
Total supplies expense			$6.34
Total mileage, 800. Average miles per gallon, 23½. Cost per mile			.00 2-3
Total days' service, 21. Average miles per day, 38. Cost per day.			.30 1-10
Approximate deliveries per day, 50. Cost each			.00 3-5

FIXED EXPENSE

Interest on $800 at 6% per year, $48. Per month	$4.00
Depreciation on $800 at 20% per year, $160. Per month	13.33
One new set tires (cases and tubes), year $90. Per month	7.50
Insurance (value $600), per year $16.50. Per month	1.37
License and tax per year, $6. Per month	.50
Driver's salary. Per month	.....
Garaging of car. Per month	.....
Total	$26.70
Grand total expense for 1 month's operation, including supplies and fixed expense	$33.04

STUDEBAKER 20 DELIVERY CAR

To a South Bend Grocer — Saturday, Oct. 15, 1912

SUPPLIES EXPENSE

Total gasoline consumed, 3½ gallons, at 15 cents per gallon	$.49
Total oil consumed, 1 pint, at 34 cents per gallon	.05
Total cost for day	$.54
Average cost of operating car per mile	$.012
Average cost of delivering each package	.005
Approximate cost of operating car 6 days a week at say 60 cents a day	$3.60
Cost of supplies for running car by the month should not exceed	$15.00

FIXED EXPENSE

Interest on $825 at 6% per year, $49.50. Per month		$4.125
Depreciation on $825 at 20% per year, $165. Per month		13.75
One new set tires (cases and tubes), year, $90. Per month		7.50
Insurance (value $600), per year, $16.50. Per month		1.37
License and tax per year, $6. Per month		.50
Driver's salary (approximate). Per month		60.00
Driver's delivery boy (approximate)		20.00
Garaging of car		.....
		$107.245
Fixed expense operating car per month	$107.245	
Supplies expense operating car per month	15.00	
Total	$122.245	
Fixed expense operating car for 12 months or one year, including supplies expense ($122.245)		$1,466.94
Annual overhauling of machinery, and incidental repairs to car due to wear and tear and service of car. (Estimated)		50.00
		$1,516.94
Average cost operating car per day, 300 days in year		$5.00

(In figuring the cost of horse-drawn vehicles, your total year's cost should be figured with the regular **365** days that makes up a full year.)

not used automobile delivery before; after a certain time, progressive companies supplant this stock form by specially designed blanks better adapted to the specific requirements of the company's operating conditions. The Studebaker Corp. also supplies the double form shown in Figs. 2 and 3. This form enables a user to figure totals and averages and the corporation assists him in calculating his fixed expense and depreciation, so that every month he may charge off a certain amount in addition to the running expenses and know to the dollar how much it costs him to operate a car per month, per day, per mile and per package.

Now to the practical record examples. The operating record for the month of August of Joseph Grueger & Son, South Bend, Ind., on page 815, shows a total expense for the month of $94.25, which includes a supply cost of $7.55, figuring gasoline at 14.5 cents per gallon, which, of course, would be too low for any locality farther away from the sources of the national gasoline supply. The amount, $7.55, may seem low, but is explained by the entire absence of repair and incidental expenses. On the working days during August, 1912, the Studebaker 20, to which the record refers, covered a total of 480 miles, making the supply cost per mile 1.5 cents. Figuring an average of seventy deliveries per day, the supply cost per delivery is one-third of a cent. The fixed expense is $86.70, which includes a monthly driver's salary of $60, without which the expense would only be $26.70. Assuming that the owner could run the car himself he could save $60 a month, bringing the total expense of operation down to $34.25, or the total cost per package delivered to 1.63 cents.

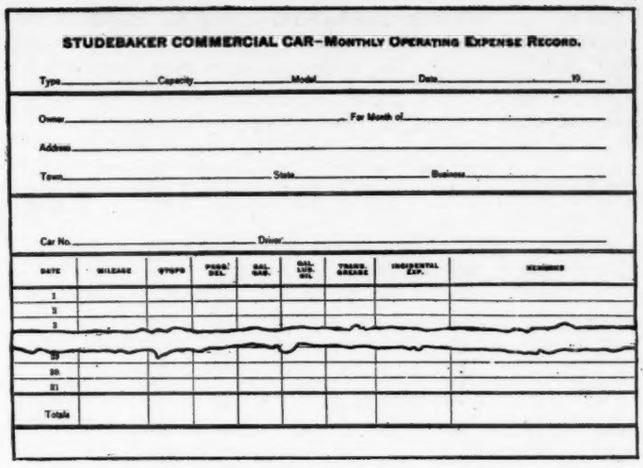


Fig. 2—Monthly record blanks for digesting data

Another instance which, while higher in certain items results in a lower total, is that of J. Bergsted's Studebaker 20, the operating record for August, 1912, appears herewith. Like the previous instance, the car referred to in this case is used in grocery deliveries and makes about fifty deliveries a day which, however, are distributed over a wider area than in the case of the other car. Consequently, the supply cost per delivery is .6 cent as compared with .33 in the case of the first-mentioned car. The fuel cost per mile, however, is only .66 cent, against 1.5 cents in the case of Grueger's car. The car operates only 5 days during the week; the owner starts out at 6 a. m. and calls on his customers to take their orders. At 8 he returns to his store and then sets out to deliver the goods as well as those ordered over the telephone. By driving the car himself, he saves the salary of a driver, while the clerk who attends to the store during his absence is required there anyway and his pay is considerably less than that of a driver. Due to this economy the total operating cost of $33.04 per month is realized, which, distributed over 1,050 packages, makes the total delivery cost per package 3.2 cents, or practically twice the cost of the first example. However, the automobile delivery enables the owner to

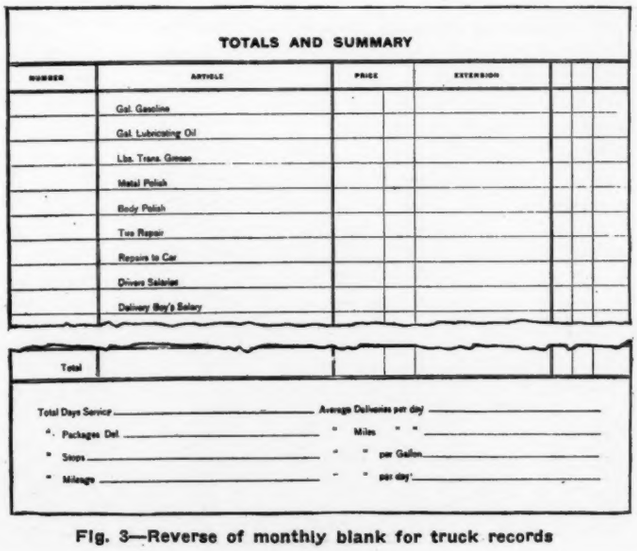


Fig. 3—Reverse of monthly blank for truck records

ACTUAL OPERATING EXPENSE RECORD OF TWO STUDEBAKER 20 PANEL DELIVERY CARS

Owned by.....
Geo. Wyman & Company,
South Bend, Indiana

For Month October, 1912
Department Store

CAR NUMBER, 2. DRIVER, EMERY COVERDALE

Date	Mileage	Stops	Pkgs. Del.	Gals. Gas.	Gals. Lub. Oil	Wash and Polish	Tire Repair—Remarks
1	38	38	50	4	1 qt.		
2	35	39	64	5	1 pt.	Yes	
3	49	33	52	5	1 pt.		
4	43	48	52	3	1 qt.		
5	42	40	48	5	1 pt.	Yes	
7	44	58	62	2	1 pt.		
8	38	29	68	5	1 pt.		
9	31	32	34	5	1 pt.	Wash	
10	37	44	53	4½	1 pt.	Wash	
11	35	51	79	1	1 pt.		Exchange carburetor
12	52	44	56	4	1 pt.	Yes	
14	34	35	37	4	1 pt.		Cleaned engine
15	40	43	45	1	1 pt.		
16	37	46	55	5	1 pt.	Yes	
17	43	50	59	4	1 pt		
18	44	55	71	4	1 pt.		½ lb. Trans. Grease
19	47	49	68	1½	1 pt.		
21	45	44	55	4	1 pt.	Yes	
22	47	44	58	5	1 pt.		
23	41½	44	61	3	1 pt.	Wash	
24	44	39	44	3	1 pt.	Wash	
25	49	61	69	2	1 pt.	Polish	
26	51	59	69	5	1 pt.		
28	43½	41	43	2	1 qt.		
29	43½	34	52	5	1 pt.		
30	18	8	14	5	1 pt.	Yes	
31	19½	23	24			Wash	One puncture

CAR NUMBER, 3. DRIVER, R. MILLER

Date	Mileage	Stops	Pkgs. Del.	Gals. Gas.	Gals. Lub. Oil	Wash and Polish	Tire Repair—Remarks
8	23	49	51	5	2 qt.		Speedometer not working. Replaced gratis
9	36	45	49	4		Wash	1 puncture. Ran over dog on E. Sample St.
10	43	65	73	4	1 qt.	Wash	2 lb. Trans. Grease
11	50	88	103		5 pt.		1 puncture
12	42	55	59	5	1 qt.	Wash	
14	51	78	79	5	1 qt.		
15	43	68	70	4	1 qt.		
16	39	68	74	3	1 qt.	Yes	
17	38	46	57	5	1 qt.		
18	47	84	93		1 qt.		
19	47	61	65	5	1 pt.		
21	43	60	64	5	1 qt.		
22	44	55	69	5	1 pt.		
23	43	56	68		1 pt.		
24	34	56	62	5	1 pt.		
25	43	72	76	5	1 qt.		
26	54	72	74		1 qt.	Polish	
28	31	52	48	5	1 pt.		
29	48	63	66	5	1 qt.		
30	50	65	73	5	1 qt.	Yes	
31	38	53	54	5	1 qt.		Coverdale used No. 3 until noon

FIXED EXPENSE

Interest on two cars at $825 each—$1,650 at 6% per year	$ 99.00
Depreciation on two cars—$1,650 at 20% per year	230.00
Two new sets tires (cases and tubes) $90 a set per year	180.00
Insurance (value $600 each) per year	33.00
License and tax per year, two cars	12.00
Garaging or car-rent (dead storage), $60 per car	120.00
	$674.00
Fixed expense per month	$ 56.16
Total supplies expense per month	134.77
	$190.93
Annual operating expense (12 months), supplies and fixed expense	$1,391.24

SUMMARY AND TOTALS

Number		Price		Total
177	gallons gasoline at	$.15	per gallon	$ 26.55
7	gallons 3 qt. oil at	.34	per gallon	2.64
2½	pounds trans. grease at	.33	per pound	.83
3	punctures (inner tubes) at	.25	each	.75
	Salary two drivers			104.00
				$134.77

Days' service (2 cars), 48. Total miles run, 1,994. Total stops, 2,444. Total packages delivered, 3,095. Average deliveries per day, 64. Average miles per day, 41½. Average miles per gallon, 8¼. Average cost per day each car, $2.81.

HORSE TRANSPORTATION ANALYSIS

INVESTMENT

Stable equipment	$1,000.00	
5 horses at $225	1,125.00	
5 one-horse panel wagons at $200	1,000.00	
5 sets single harness at $35	175.00	$3,300.00

ANNUAL OPERATING EXPENSE OF HORSE SERVICE.

Interest $3,300, 6%	$ 198.00	
Depreciation and repair:		
Horses, $1,125, at 15%	168.75	
Wagons and harness, $1,175, 20%	225.00	
Maintenance and labor:		
Feed—5 horses at 50 cents x 365 days	912.50	
Rent—shoeing, medicine, insurance—5 horses at 30 cents day x 365 days	547.50	
Drivers (average):		
1 man at $2.50 x 365 days	912.50	
4 men at $2.00 x 300 days	600.00	3,564.25

	Horses	Motor	Saved
Total expense per month	$ 297.02	$ 190.73	$ 106.29
Total expense per year	3,564.25	1,391.24	2,173.01

greatly increase his business radius and there the profit comes in.

On this page full calculations of cost referring to two Studebaker delivery wagons used by a South Bend department store are given. The figures are arranged in a form digesting the schemes of both Figs. 2 and 3. An exact survey of the figures will undoubtedly prove of interest to truck users. The calculation of fixed and total expense result in a total cost, for the two trucks, of $1,391.24 per year, as compared with $3,564.25, the cost of horse delivery of the same amount of goods. Companies having experience with horse delivery will be in a position to check the horse figures which are not out of the ordinary, but rather normal; while the automobile fixed expense are taken relatively high, as is seen by the interest charged at 6 per cent., the depreciation at 20 per cent. and the provision of two full sets of tires for 1 year's service.

An interesting record which is well suited to be included with the description of the cost-keeping systems above described is that of a demonstration made by the Studebaker Corp. to a South Bend grocer on October 5, 1912. On pages 814 and 815 the results of this demonstration appear tabulated, much in the same manner as the daily record, Fig. 1, except for greater detail. In making a delivery car demonstration, the corporation, of course, attempted to determine exactly the work done during all the time spent by the truck in demonstration work, and for this purpose not only the number of miles covered and packages delivered, as well as fuel and lubricants consumption, are given, but also the time during which the car was running on each trip, the time spent standing while delivering parcels and the time spent in loading the car again. In this manner a most exact record is obtained, which is best fitted to convince a prospective buyer of the advantages of a truck. The average operating cost per mile was, in the case of the demonstration here recorded, 1.2 cents and that of delivering each package .5 cent. In addition to giving the report of the demonstration made, the corporation supplies the prospective customer with an estimate of truck operating cost based on this experience, so that the whole situation is put clearly before him.

By instructing its customers how to properly record the cost of operating their trucks, the Studebaker Corp. makes it possible for them to soon arrive at a very economical basis of operation. As a result, there is little difficulty in satisfying the purchasers, and a satisfied buyer is always a promising prospect.

Among the New Books

Works on Machine Practice, Automobile Construction, Scientific Management and Metallurgy Are Offered

Third Annual Appearance of the Automobile Engineers Yearbook for 1913—Book Indicates British Trend

MACHINE DESIGN HOISTS, DERRICKS, CRANES. By H. D. Hess, M. E., Professor of Machine Design, Sibley College, Cornell University. Published by J. B. Lippincott & Co., Philadelphia, Pa. 386 pages, with 318 illustrations and 18 inserts. Cloth, $5.

Either as a book of reference or as a text-book on machine design, applied especially to hoist derricks, cranes and allied subjects, this work will be found most complete. The different principles of mechanics involved in the study of these particular branches of machine design embrace so broad a field that it practically covers a general course in this branch of applied science. As the author states, the book is intended to aid the work of machine design in technical schools and colleges and to serve as a reference work in drafting rooms where a general field of machine design is covered. The author has drawn from prominent engineering sources much of his information and supplies the rest by a queerly expressed compendium of compiled information. The early chapters of the work lead into the more detailed study later by giving the elements of the strength of materials entered into the construction and design of all hoist, derrick and crane parts.

WORM GEARING. By Hugh Kerr Thomas. Published by McGraw-Hill Book Co., New York City. 86 pages, with 33 illustrations and numerous tables. Cloth, $1.50.

In this work the author has probably for the first time devoted a whole work to the branch of applied mechanics known as worm gearing. The growth of the worm gear throughout England for the past few years and its introduction into America renders this book of timely interest to the automobile manufacturer and to those interested in the construction of passenger and commercial cars. In fact, the author, although dealing with the worm gear as a general subject, especially considers its application of the rear axle of the automobile and has illustrated this phase of worm gear thoroughly. The work on the worm gear and its ramifications is exhaustive from both theoretical and empirical standpoints.

MOTOR CAR PRINCIPLES. By Roger B. Whitman. Published by Appleton & Co., New York. 335 pages, with more than 100 diagrammatic illustrations. Cloth, $1.50.

Designed as a sister work to *Gas Engine Principles* by the same author, this book, as naturally would be expected, deals with the entire chassis. The engine is given particular attention, however, in a clear and explicit manner. It is a book that renders possible the comprehension of the motor car by the owner or driver new to the mysteries of automobile and gas engine construction. Although elementary in character, the work is sufficiently advanced to provide all the knowledge necessary for a thorough understanding of the principal mechanical features of any car. The movements involved are clearly defined and as far as the purposes of a car owner are concerned the book is complete.

SCIENTIFIC SALES MANAGEMENT. By Charles W. Hoyt. Published by George B. Woolson & Co., New Haven, Conn. 204 pages, illustrated by numerous forms and engravings. Cloth, $2.

The principles of scientific management are difficult to apply to such an occupation as that of a salesman. The personal element is so strong in this line of work that it takes the most careful study to be able to make the application. The personal element reason is not the only one to be reckoned with. The difficulty attached to keeping in touch with a man who is many hundred miles away from the central office renders it necessary to apply considerable thought to the control of the salesman. The author points out the methods employed by different large concerns and suggests others which are the fruit of the author's investigations along these lines. The value of conventions, meetings and councils for salesmen is discussed in the work and the bad effects of the so-called "ginger talks" are also brought out. The value of contests, competitions, house organs, percentage distribution and sales promotion by various means are thoroughly considered and discussed. An interesting chapter is that on the standardization of sales arguments in which printed manuals are given, furnishing a list of questions which may be asked by the prospect and the standard answer which has been worked out, in all probability, at one of the salesmen's conventions.

MIXED METALS OR METALLIC ALLOYS. By Arthur H. Hiorns, head of metallurgical department, Birmingham Municipal Technical School, third edition, revised and enlarged, published by Macmillan & Co. New York City. 469 pages, with zinc illustrations. Cloth, $1.50.

The object of the author is to show what the uses of mixed metal are and where each particular alloy would be most suitable. The preparation of alloys is taken up in the early part of the work, along with a discussion of the nature of the different metallic elements and their methods of working. After this discussion the nature of each class of alloys, such as copper, brass, zinc, silver, etc., is discussed separately in separate articles. The book should be valuable as a handbook as it is arranged in a logical order and takes up the story of mixed metals where the volumes on metallurgy generally leave off.

THE AUTOMOBILE ENGINEER YEAR BOOK FOR 1913. Published by the Automobile Engineering Publishing Co., Ltd., 20 Tudor street, London, E. C. Boards, 1 shilling.

This is the third annual automobile year book. It contains tables and data of special application to automobile work. It is a hand-book of the material, design and features of construction entering into all grades of motor cars. Besides this, methods of making the calculations necessary in automobile design are explained and the work is supplemented by tables giving the specifications of the leading English, Continental and American cars, with illustrations of modern design for engines, gearboxes and axles. It is a complete indicator of the trend of motor car design as seen in the British market.

A PRIMER OF THE INTERNAL COMBUSTION ENGINE. By H. E. Wimperis, M. A. (Cantab.) 143 pages, with numerous illustrative half-tones and diagrams. Cloth, $1. Published by D. Van Nostrand Co., New York City.

Primarily intended as a text-book, this work furnishes an excellent review course. The different chapters throughout the book are supplemented by examples to be worked by the student. The answers to these questions and examples are given in the back of the book and afford a check on the work of the student. The eight chapters are devoted to an introduction and past history of gas engines and a chapter on heat thermodynamics, practical engine problems, gas producers, design and testing. The more important engines of the early days, such as those of Otto, Lemoir, etc. are shown in diagram and carefully explained.

GAS ENGINE PRINCIPLES. By Roger B. Whitman, author of Motor Car Principles, published by D. Appleton & Co. New York City. 248 pages, with seventy-four line drawings and diagrams. Cloth, $1.50.

There are fifteen chapters in this book, all devoted to the gas engine. The first chapters take up the early forms of motor and give a short résumé of the thermo-dynamics involved in the gas engine. The remaining chapters are devoted to carburetion, ignition, lubrication, cooling, care and maintenance. The three last chapters in the work are on motor troubles. The first gives the causes, second gives the effects and the third gives the method of locating the trouble. Large type and good paper help to make the subject matter readily comprehendible. As a text book it would give great satisfaction.

Believes in Wire Wheels—Removing Rust from Metal Body—How to Take Out Stubborn Round-Head Bolts—Effect of Sea Air on a Car—What Is the Meaning of the Word Horsepower?—Deduction of the A.L.A.M. Formula

Views on Wire Wheel Situation

EDITOR THE AUTOMOBILE:—The recent adoption of wire wheels as optional equipment by a number of automobile manufacturers revives interest in the relative advantages of the two types of wheels.

The most valid objection against the wire wheel is the fact that wire spokes will rust, and because of their great number and the way they are interlaced, wire spokes are very difficult to keep clean.

Some people object to the appearance of wire wheels, as they claim that the massive bodies of our modern road locomotives look better when supported on spokes of adequate size, but this objection will probably disappear as we become accustomed to the wire spokes.

That the wire wheel is stronger, especially against side strains, may be accepted as well established, in view of the fact that the design of a wire wheel permits of the distribution of the material to the best advantage. This ability to withstand wide strains is most important, as it is through side thrusts that wheels most frequently collapse.

The fact that the wire wheel was once in almost universal use, only to be displaced by the artillery type, is not conclusive proof of the inherent defects of the wire wheel as a type; for the recrudescence of old ideas in improved forms has been a frequent occurrence in the automobile industry. The use of improved materials, such as non-rusting alloy steels, Monel metal, or bronze wire having a high tensile strength, would remove all objections as to the rusting of wire wheels and would probably be a strong factor in promoting their universal introduction.

Allegheny, Pa. MURRAY FAHNESTOCK.

Compression Fallen Off

Editor THE AUTOMOBILE:—The compression in my motor was greatly reduced just after I had my valves ground. It is now all right. Why is this?

New York City. READER.

—It is very common that a motor has poor compression immediately after carbon is taken from the cylinder. This is due to small particles which lodge on the valve seating, where the cleaning has not been carefully done. The compression soon returns.

The present practice for compression pressure in the modern touring car averages about 65 pounds to the square inch, cold. There are some cars, however, which run as high as 85 and 90, although it is very undesirable to go quite as high as the latter figure in a small or medium-powered car used for touring purposes. Take your compression, however, by gauge, which could be inserted in the spark-plug aperture, rather than by attempting to determine it by volumetric computation. It is impossible to accurately compute the volume of the combustion chamber by any of the empirical formulæ.

Rust Spots on Car Body

Editor THE AUTOMOBILE:—Is there any remedy or preventative for rust spots on a car body except repainting? My car has two or three small patches of rust on the doors, the finish being in good condition otherwise. This rusting will, of course, spread unless something be done to prevent it. What would you advise?

2—There are certain greases on the market which contain wood fiber for use in gear boxes and differentials. It is claimed the use of this grease prevents noisy gears. Is the use of such grease harmful to the gears?

3—Are not the rather complicated and heavy electrical outfits carried on most modern cars a step in the wrong direction, inasmuch as they add much complication and weight to a machine which already has enough of these attributes? It seems to me that, although these electric starting and lighting systems may be all right in the hands of expert chauffeurs, for the average owner who does his own driving they are too complicated to be a very great help or convenience. For instance, what would a driver, who is not an electrical expert, do if he should find himself some dark night, 20 miles from assistance, with his electric lights out and no way of starting his motor? These electric systems do sometimes balk, statements of their makers to the contrary notwithstanding.

With acetylene lights the cause of their failure to work is always easily located and remedied, which cannot be said of most electrical systems.

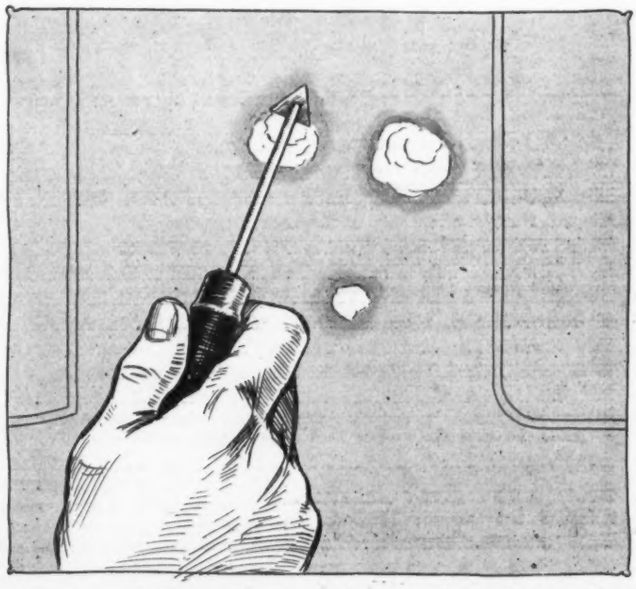


Fig. 1—Use of the scraper comes first in taking off the worst of the rust. The triangular scraper can be used for this work

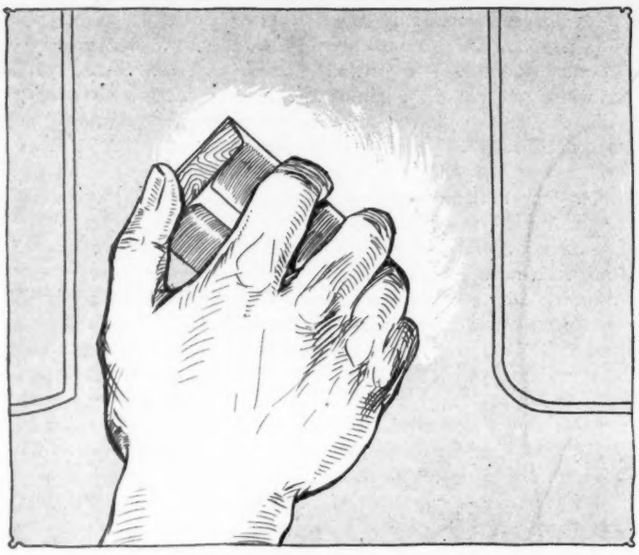


Fig. 2—Using the emery cloth. Put block of wood beneath to secure firm backing

The salesmen and demonstrators are woefully ignorant of the electrical systems on the cars which they are trying to sell. Last winter at the shows many salesmen did not know whether their cars were equipped with 6-volt or 60-volt systems. They did not know how much the system added to the car's weight, how much power they used up, some did not even know where the different units were located. If men who sell cars for their business cannot answer these vital questions, how can the non-technical owner be expected to maintain and operate these electrical puzzles?

East Canaan, Conn. D. C.

—1—The only remedy is to remove the rust spots and touch up with a little paint. This will, of course, leave these spots of paint standing out from the other paint on the surface of the car, but the appearance will not be so bad as it would be were the rust left on the body. If your car has not a polished finish, it would be possible to give the entire car a coat of paint or two. This is done frequently with cars finished in a dull battleship grey or similar colors.

Removing the Rust

The method in removing the rust will be to first scrap off the rougher part of the rust and then finish by rubbing with emery and finally with cloth and kerosene. This will give a smooth surface that will hold the paint. The latter should not be applied, however, until the kerosene has entirely vanished from the surface of the metal. A good painter can touch up small spots so they can hardly be noticed after a few days' use of the car. The degree to which the new paint is apparent, however, depends to a large extent on the color of the car.

About the best method of applying paint to spots and fading this paint off into the older painted parts is to employ a paint gun. By this method the paint is sprayed on the surface of the metal and the amount put on in each particular spot can be gauged to a nicety. The progressive steps in the work of removing rust and coating the surface of the metal are shown in Figs. 1, 2 and 3. Fig. 1 illustrates a method of doing the scraping work. The scraper used may be of any type, even an ordinary piece of metal being sufficient for the purpose. It is necessary to use such a device to break the harder accumulations of rust and to get it started. Fig. 2 shows how the body should be rubbed gently with fine emery. A block of wood is used to give a hard surface beneath the emery and to be able to apply the pressure at the necessary points. After the emery has done its work and taken off the last perceptible bit of rust and the metal is bright and clean, the paint is sprayed on with the paint gun, as in Fig. 3, or a brush may be used instead of the gun.

As far as rust preventives are concerned, it may be stated that the only method to pursue is to keep the metal work painted. A combination of moisture and air will always cause rust, and since along the East Coast the air contains more or less saline moisture it is necessary to be particularly careful.

2—Greases such as you mention are merely temporary devices for preventing noise. If a gear is worn badly enough to require some such means of silencing it, it will surely go further in a short time. As far as harming the gears is concerned it is doubtful if actual damage would be done. The only thing to be feared is that the wood fiber of a somewhat stringy nature may get into the bearings and prevent their functioning as freely as they should.

3—It cannot be said that the electric systems which have proven so popular during the past 2 years are a step in the wrong direction. The care of these systems is so simple that it is a fact that the car manufacturers who use this system say the more the driver or owner leaves the system alone the better they are satisfied, with the exception, of course, of adding a little distilled water to the storage battery from time to time.

The supposition you make of a driver finding himself some dark night 20 miles from assistance with his lights out and no way of starting his motor is highly improbable. It would mean that the storage battery was exhausted or that the generator had failed to store it or to operate correctly or that the car was not equipped with an auxiliary ignition system. Where the storage battery is depended upon to furnish ignition as well as lighting and starting current, there is always a set of dry batteries to use in an emergency. Where the magneto is used, the dry cells are, of course, not required.

Convertible Lamps Used

As for the lights, the side lamps generally supplied are of the combination kerosene and electric type so that should anything happen to the electric system the kerosene part of the lamps may be used. This leaves a fairly good emergency equipment in case the complete breakdown you mention should ever occur. It may also be said of the acetylene system that if you were in a bad place and your tank went empty you would have a hard time getting home. You are no doubt right in stating that it would be easy to find out the cause of the trouble, but it would be harder to remedy the trouble on the road. It all comes back to care on the part of the owner. If he lets his acetylene tank run empty or allows the electrolyte in the battery to become bad through his failure to add water he must shoulder the responsibility and not try to put it off on the manufacturer or an alleged complicated system in the usual manner.

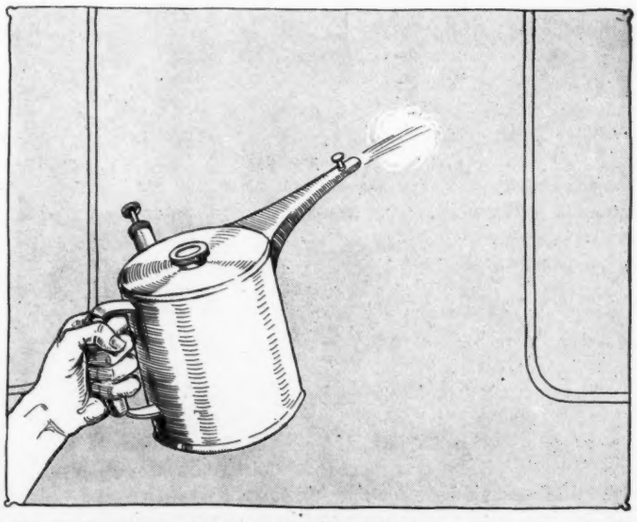


Fig. 3—Spraying paint on spot with paint gun. New color should fade into old

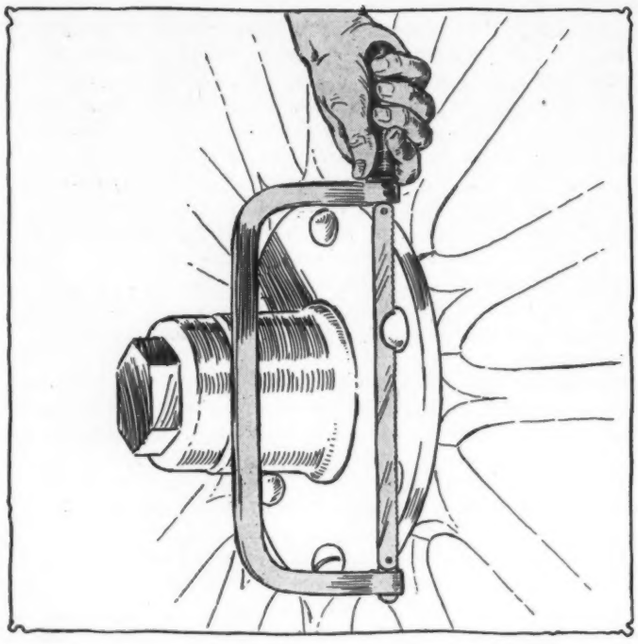


Fig. 4—Slot the heads of the round-headed bolts to make space for screwdriver

Your statement in regard to the ignorance of salesmen on the electric starting and lighting outfit is true in most respects. You must remember, however, that in many instances the cars seen at the New York show with electric starters were merely sample cars and the first to appear with this equipment. In fact, many of the cars which went to the Garden and the Palace have never been inside of the New York showrooms and the salesmen themselves saw these hurriedly assembled products for the first time at the automobile show. Since that time many have become familiar with the details and construction of these starters and have mastered the electric knowledge necessary in explaining them to prospective buyers.

In many instances the cars which were equipped with electric starters at the Garden and Palace shows had the electric equipment fitted on them in such a hurry that it has been decided to change the method of installation. It did not take a keen student or observer to note that the method of drive and mounting employed on some cars were so weak that it could not stand up under the vigorous requirements of electric cranking.

As far as the non-technical owner is concerned, he need only confine himself to adding water to his battery and to operating his starting switch when he wants to start the motor.

Storing a Car in Salt Air

Editor THE AUTOMOBILE:—I am a winter resident here and expect to store my car for the summer. As the salt air is bad for rust I will ask for advice:

1—The best way to leave the radiator. Some recommend filling with rain water and keeping full. Others to fill with water with some oil on top and the drain so the oil will form a coating on the metal as the water lowers. Others say to flush and dry out and nothing else. I have been thinking that after cleaning and drying out it might be a good plan to fill with a light grade of cylinder oil and before using clean with warm water and sal soda to remove what remained after draining. This would clean out the oil,

2—The best way to leave engine. Will it be best to leave everything intact, as used—oil in reservoir, ignition connected. etc., and wrap a blanket around to keep out moisture? How would it be to inject a gun of cylinder oil into each cylinder and then turn the engine over a few times so as to give the walls extra lubrication to prevent rust and insure easy starting? Have heard of cases where the piston rusted fast.

3—Would you advise something for the leather, and have you anything to recommend?

4—Is it good policy to entirely deflate tubes? My experience has been that tubes left partially inflated on wheel were all right when put in use again, while those which were taken out and left flat developed cracks when put under pressure.

Daytona, Fla. J. W. F.

—1—If you are willing to sacrifice the rubber hose connections on your radiator the best way would be to fill the water system with kerosene oil. You can then be absolutely sure that the radiator will remain uncorroded and that the water-jackets will not rust, no matter how long you leave your car exposed to the sea air. Any oil would suffice for this purpose but kerosene is mentioned on account of its cheapness and the fact that it will fill the bill as well as anything else. Another method is to fill the radiator with rain water and then seal it so that it is impossible for any air to enter. Water alone cannot cause rust. It requires the presence of free oxygen and this is only found to any extent in the atmosphere. The free oxygen present in and around sea coast towns owing to the ozone-like atmosphere and the presence of a large amount of water vapor render rusting processes rapid. When the atmosphere is not allowed to come in contact with the metal while it is damp but little rust will form. If this method is to be used the radiator should be filled to its very top, corked and the cap then screwed tightly in place. The radiator overflow pipe should also be corked.

Oil Needed in Cylinder

2—If you will run your motor for a short time with an excess supply of oil getting it up to high speed and then cutting off the ignition so that it will have opportunity to throw itself over several times or be thrown over by the weight of the car in coming down a hill or coasting up to the garage there will be sufficient oil in the cylinder to avoid all chances of rust during the summer. If you were to shoot a gun full of cylinder oil into the cylinders, it would deposit in a thick layer on top of the piston and give you carbon trouble when you again started your motor next fall. The outside of the motor should have every bit of rust scraped off and a coat of black engine paint put over it.

3—You should take a can of neatsfoot oil and go all over the leather work. This will keep it soft and will not permit it to crack or break when again used. If you use a leather cone clutch, this should also be soaked with neatsfoot oil to keep it soft while the car is not in use. In lieu of neatsfoot oil castor oil may be used. The odor of the latter is not so pleasant, however, and the neatsfoot oil is more advisable.

4—You should partially deflate the tire and block the car up to take the weight off its wheels to relieve the strain on them as much as possible. Leave about 30 pounds pressure beneath. Do not store the car in a place where the sunshine can beat in on the tires or on the body. The best place to keep tires is in a cool, dry, dark spot where the temperature does not exceed 70. This may be an impossibility, but you should approach it as nearly as possible. It would be wise to take the tires off and coat the rims with graphite paint in order to prevent any possibility of the tires rusting on the rim. It would be also wise to throw a large cover over the car while it is in storage.

Explanation of Horsepower

Editor THE AUTOMOBILE:—Please let me know what is meant and how is the horsepower of an engine determined and when does this engine develop said horsepower?

Brush, La. M. W. LENERT.

—To understand what horsepower means one must first understand what the meaning of the term foot-pound is. A foot-pound is the amount of energy required to lift the weight of 1 pound 1 foot. Two foot-pounds of energy are required to lift a 1-pound weight through a distance of 2 feet or to lift a weight of 2 pounds through a distance of 1 foot. In other words, foot-pounds are the products of weights multiplied by distances. For

10 pounds to be lifted a distance of 10 feet would require 100 foot-pounds of energy.

Power is energy applied at a given rate. A horsepower is 33,000 foot-pounds applied in 1 minute. That is, if 1 pound was lifted a distance of 33,000 in 1 minute 1 horsepower would have been exerted, or if 66,000 pounds were lifted a distance of 1 foot in 1 minute 2 horsepower would have been exerted.

Power Includes Time

When it is understood that a horsepower is the power required to exert 33,000 foot-pounds of energy in a minute, the horsepower of a motor will be readily understood. Suppose that to move a car of given weight at a speed of 1,000 feet per minute a steady resistance of 330 pounds was offered. In pushing this 330 pounds resistance through a space of 1,000 feet 330,000 foot-pounds of energy would have been exerted in 1 minute. In other words, since 33,000 foot-pounds per minute make a horsepower, 10 horsepower will have been exerted by the motor.

When a motor is tested on the block in the laboratory the throttle is opened wide and the motor is made to work against the greatest resistance it can overcome. Supposing that the motor exerts a given pull during the period of 1 minute and this pull is exerted through a certain leverage. We would have the factors necessary to calculate the horsepower of that motor because we would have the foot-pounds per minute exerted. The resistance against which the motor works is commonly secured by means of a brake, and consequently this horsepower which is calculated from the tests on the laboratory block has been named the brake horsepower. This is the horsepower of the motor which is commonly referred to. The motor develops this horsepower when it exerts the energy in foot-pounds corresponding to the horsepower rating.

There is another kind of horsepower known as the indicated horsepower and the letters i. h. p. are used to designate it, while the brake horsepower is generally expressed by the letters b. h. p. The indicated horsepower is figured in this manner:

The exploding gases exert during the working stroke and average pressure P upon the heads of the pistons. This average pressure is what is known in engineering work as the mean effective pressure, and is often expressed by the initials m. e. p. Since the pressure P is expressed in pounds per square inch the total pressure will be this pressure P times the area of the piston head A. That is, during the working stroke these is a pressure P. A. being exerted on the head of the piston. This working stroke pressure is in pounds. If it is multiplied by the length of the stroke L we will have the foot-pounds exerted by the exploding gases. We have but to bring in the factor of time to get the expression into foot-pounds per minute. If the engine is turning over N revolutions per minute and it is a four-cycle engine there will be $\frac{N}{4}$ working strokes in which the pressure P. A. is being exerted or in which the energy P. A. L. foot-pounds is being exerted. In one minute, therefore the number of foot-pounds will be $\frac{1}{4}(P \times L \times A \times N)$ foot-pounds exerted. Since there are 33,000 foot-pounds per minute to a horsepower, the horsepower of the motor will be $\frac{P \times L \times A \times N}{4 \times 33{,}000}$. This horsepower is known as the indicated horsepower of the motor.

It is evident that the i. h. p. does not take into account the mechanical efficiency of the motor. That is to say the brake horsepower will never equal the indicated horsepower of the motor owing to the fact that there are frictional and heat losses which cannot be prevented. The mechanical efficiency of a motor is the relation of the brake horsepower to the indicated horsepower.

The A. L. A. M., an association of automobile manufacturers which has now passed out of existence, realizing the value of a formula which would give an approximation of the brake horsepower without the time required to make the block tests have deduced a formula from the indicated horsepower expression given above. In deducing this formula they have reasoned as follows:

They have noted that the length of the stroke times the number of revolutions per minute or $L \times N$ in the numerator is equal to the speed of the piston in feet per minute. After making numerous tests, they have decided that a motor generates its maximum power under average conditions at a piston speed of 1,000 feet per minute, has an efficiency of .75. They have therefore equated $L \times N$ to 1,000. This leaves the expression for indicated horsepower $.75\frac{P \times A \times 1{,}000}{4 \times 33{,}000}$, or $.75\frac{P \times A}{132}$

The expression area A is equal to $.7854\,D^2$. Substituting this and also 75 pounds for P, which is assumed to be the average mean effective pressure, we have by solving:

$\frac{D^2}{2.48}$ or, for N cylinders $\frac{D^2N}{2.48}$ approximately $\frac{D^2N}{2.5}$.

This formula is used extensively in horsepower calculations.

Removing Wheel Hub Bolts

Editor THE AUTOMOBILE:—I cannot remove the bolts which hold the hub on my front wheel. Round-headed bolts are used and when I turn the nut, the entire bolt turns. As the bolts are round-headed there is no way of holding them so they will not turn. How can I get them off?

Batavia, N. Y. SUBSCRIBER.

—You can get them off by following the method illustrated in Figs. 4 and 5. That is by slotting the heads of the bolts with a hacksaw and then holding them with a screw driver. This will take but a few minutes and will not mar the appearance.

Please Sign Your Inquiries

[THE EDITOR OF THIS DEPARTMENT is in receipt of several letters signed Reader, Subscriber and by initials. No attention will be paid to anonymous or unsigned letters; readers who wish to make use of these columns must sign their letters as an evidence of good faith. No names will be published if the writer of the inquiry or communication does not wish the name to appear. It is only necessary to state this in your letter. Other letters which have not been deemed of sufficient general interest to publish in these columns have arrived without the sender's address so that it is impossible to answer them by mail. We are delighted to have our subscribers use these columns and most cordially invite correspondence, insisting only on the rules just mentioned.—EDITOR.]

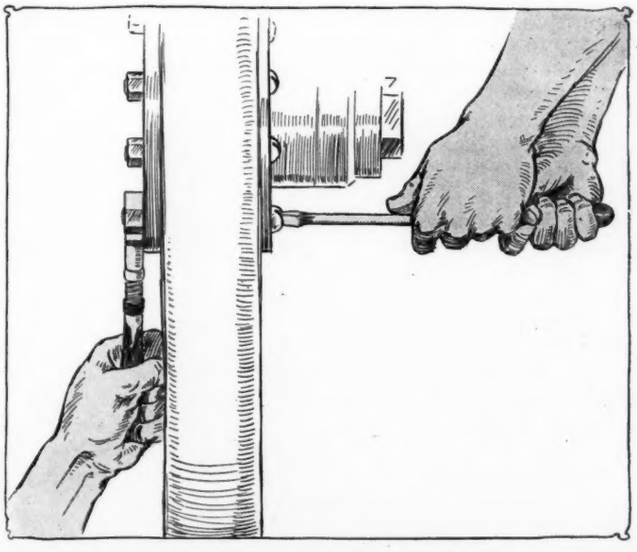


Fig. 5—Bolts can now be readily removed by holding with screw driver and removing nuts

The Automobile

Vol. XXVIII Thursday, April 10, 1913 No. 15

THE CLASS JOURNAL COMPANY
H. M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
231-241 West 39th Street, New York City

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To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order, or Register your letter.

Entered at New York, N. Y., as second-class matter.
The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903 and the Automobile Magazine (monthly), July, 1907.

The Youthful Giant

GROWING at the rate of 200 per cent. per year, the motor truck industry gives promise of soon becoming a dangerous competitor, numerically, of the passenger car industry. The latest statistical figures compiled by the commercial vehicle department of the National Association of Automobile Manufacturers show unmistakably the phenomenal growth of the truck industry since 1910, containing, as they do, the interesting fact that this year the total truck output will exceed 56,000 machines.

¶ This increase in manufacture has an added interest in that state legislatures are today focusing their major efforts for higher registration fees on trucks.

¶ In less than 18 months there will be approximately 100,000 motor trucks in use in this country, and if it were possible for legislators to increase the annual registration on these from an average of $10 per vehicle to $50 it would mean an added annual tax on the industry of $4,000,000, a sum that eventually must come out of the pockets of the makers.

¶ This year has witnessed the first concerted action of legislators to impose irrational registration fees annually on motor trucks. Next year will witness a campaign for still higher fees. It is today imperative on all concerned to work against the spirit of compromise, accepting a limited fee this year, only to be pestered next session and all thereafter for higher fees. The motor truck must bear its share of the burden, but all users of streets and public highways must pay their equal share for the use of these public thoroughfares.

A Competitive Tariff

THE Underwood competitive tariff bill has been introduced, but introduction is a long distance from passing. Introduction in such measures means the signal to begin opposition, and from this date forward opposition will be the word from many interests in the automobile industry.

Reducing the tariff on automobile chassis from 45 to 30 per cent. would mean an approximate saving of one-half this to the ultimate buyer. Reducing the tariff on finished parts of automobiles, not including tires, from 45 per cent. to 20 per cent. would mean a serious invasion in a few accessory lines, but even should such a cut be made, which is highly problematic, the increased facilities for production in the American factory would practically balance the lower wages paid to the European maker.

By a reduction in forging of iron and steel from 30 to 15 per cent. little commotion will be created because the American forging plants are better equipped for economical production than the foreign plants and while it is true that a few years ago the foreigner surpassed us in the production of alloy-steel forging, yet today the majority of these used in our automobiles are largely the products of American plants and American labor.

The most serious aspect of a possible tariff reduction is that of passing the critical point when American methods of multiple-economical production fall below the level of cheap factory labor in Europe. The labor scale in American factories is in some cases two and nearly three times that of the foreign manufacturer, and the framers of the present tariff will be defeating their own aims if by hoping to benefit the working man by reductions in the necessities of life they cut off his available income by placing him on a competitive basis with the worker of Europe, an act which would mean a cut in labor prices among the thousands of workers in the American automobile factories.

While American automobile factories are the most modern so far as equipment of any manufacturing plants in the world there is one respect in which production can be economized upon without sacrificing quality of materials, quality of workmanship or quality of appearance, and that is in the matter of more advanced systems of scientific management so far as production is concerned.

Conditions of this nature have been unearthed in many of the older industries, which had imagined they had reached the zenith of efficiency production. It is certain that in a number of automobile factories similar conditions exist. In fact, this is true in a few of our large plants. To such few makers the words of President Wilson in his message should be heeded. They are:

"We long ago passed beyond the modest notion of protecting the industries of the country and moved forward to the idea that they were entitled to the direct patronage of the government. For a long time—a time so long that the men now active in politics hardly remember the conditions that preceded it—we have sought in our tariff schedules to give each group of manufacturers or producers what they themselves thought that they needed in order to maintain a practical exclusive market as against the rest of the world."

CRIFFEN AND SIDE GUIDE

Urges Outdoor Fall Show for Trucks

Should Be Held Between the Truck-Selling Seasons—Believes That Such a Show Will Be Held Within Another Year.

By William E. Metzger

DETROIT, MICH.—April 4—The editorial in THE AUTOMOBILE for March 13, entitled "Silk Stockings on Trucks," meets my ideas precisely.

Naturally, I believe, Detroit would afford as good a location as any for a midsummer truck show. The state fair grounds here offer every necessary accommodation for such a show.

This show ought to be held, in my estimation, between the truck-selling seasons—say the middle of September to the first of October. This date would be best for the reason that most trucks are delivered to consumers just before the hot summer season or just before the cold winter season. By having the show late in September, at which time the business men would have returned from their summer vacations, I am inclined to feel that the truck manufacturer would be able to get a line on the market in time for his fall deliveries.

Nearly 2 years ago I advanced the idea of an early fall show, believing then that what the truck manufacturer needed was an opportunity to show by actual demonstration the superiority of motor trucks and the possible saving to the great and varied lines of industry which are in the market for these commercial vehicles.

This truck display at any central point in the Middle West would, I believe, bring interested people from all over the United States—people who would want to come and investigate the truck as applied to their particular line of business. The educational feature would be much enlarged by the display of the various labor-saving devices that accompany the trucks, many of which are being made by independent concerns, not truck manufacturers. Contests could be had in the loading and unloading and the carrying of various commodities. These tests would forcibly bring before those interested throughout the country the actual loss that they are sustaining daily in their various lines of business by not using up-to-date truck equipment, and this necessarily would be of great benefit to the truck manufacturers. Personally, I cannot see, excepting from a selfish standpoint on the part of some makers who fear competition, any possible reason why one commercial show held in the early fall is not the best solution of the matter of commercial shows. In all of my talks with various truck manufacturers, not one of them has advanced a reason against this show, which to me seems logical. I am inclined to believe that such a show will be held within another year.—WILLIAM E. METZGER.

Why Should Automobilists Pay State Fees?

By Charles E. Duryea

SAGINAW, MICH., April 4—I am much pleased to see your editorial on "Raising Revenue," which appeared in THE AUTOMOBILE for March 20. This is a matter on which automobilists have been asleep all these years. Just why they should pay for as a privilege that which is their constitutional right, namely, the right to use their machines on the highways, as freely as other vehicles use them, is a question I have never been able to understand. The bicycle people fought this matter to a finish, and won, many years ago; and one of the automobile magazines coming directly from the bicycle business has maintained a consistant stand on this ground, but most of the others have paid no attention to this important question.

That it is a matter of revenue only is readily seen by watching the progress of this form of taxation in the various states. New York at first issued a perpetual license, or tag, for identification purposes, but lately seeing an opportunity for revenue has made it an annual one. There is no excuse for such action. One registration during the ownership of the vehicle is just as good as a dozen so far as police protection is concerned. Further, the mere cost of registration at the most is all that should be charged. If the automobile user must pay toll, he is discriminated against, and such legislation is objectionable class legislation. How it works in Pennsylvania may be shown by the following facts:

The commissioner of highways has full power there. My motor buggies were not serially numbered, and my owners could not give manufacturer's number. A statement to this effect brought licenses 1 year, but the next year they were refused, although the law had not been changed. The owners appealed to me, and I took the matter up with the highway commissioner, who insolently replied that it was none of his business. The law required a manufacturer's number to be given, and if there were none, why no license was issued, or words to that effect. If this is not confiscation of property, what is? After considerable delay and inability to use their cars the commissioner relented enough to issue the licenses without a manufacturer's number, as he had previously done. Not only is this an outrage which no American citizen should be compelled to stand for, but it is rank idiocy. I could have conveniently supplied numbers to those particular owners and no one would have known the difference. They would have been my numbers so far as the law was concerned, but of what value would they have been to the state department or anybody else, and how could the commissioner of highways know whether or not those numbers were correct ones? Further, most vehicles are numbered, if numbered at all, on a removable metal plate, so there is nothing to prevent moving the plate if the owner desires to transfer the number to some similar vehicle.—CHARLES E. DURYEA.

CRIFFEN AND SIDE GUIDE

Struggle Against Bills

Pennsylvania Automobilists Endeavor To Stop Bad Legislation—Many Measures Against Trucks

HARRISBURG, PA., April 5—Automobilists in this state are rallying around the Pennsylvania Motor Federation and the various dealers' organizations in their effort to stem the flood tide of motor-mad legislation now pending before the legislature here. Senator Buckman's bill is the bone of contention. This bill was originally drafted by the Pennsylvania Motor Federation, but was changed in not a few respects before its introduction so that in its present form it is being opposed not only by the Federation but by all other motoring interests in this state. This bill has a new scale of registration fees for passenger cars and motor trucks. The fees for passenger cars are according to horsepower, and those for motor trucks according to gross weight. Following are the fees:

Passenger cars under 20 horsepower	$5.00
Passenger cars under 20-50 horsepower	10.00
Passenger cars over 50 horsepower	15.00
Motor trucks under 4,000 pounds	10.00
Motor trucks under 4,000-5,000 pounds	15.00
Motor trucks unler 5,000-10,000 pounds	20.00
Motor trucks under 10,000-15,000 pounds	25.00
Motor trucks under 15,000-20,000	30.00

By this schedule the registration fees on motor trucks are more than doubled as compared with the present fees, but other bills have been introduced which make these fees $30, $50 and $100 according to the load capacity of the trucks.

Restrictions on Motor Trucks

This new legislation places further restrictions on motor trucks, in that the maximum weight of a truck with its load is 20,000 pounds, or 10 tons, and that of this total, not more than 15,000 pounds can be carried on one rear axle. This places a restriction on present methods of truck construction in which the total gross weight carried on the rear axle is sometimes 80 and as high as 85 per cent. of the total gross. Naturally trucks of this construction wil be barred from the highways if such legislation were to be enforced. There is at present a movement to get the maximum permissible weight on a truck increased to 25,000 pounds, but it is certain that this is being opposed by certain canal interests throughout the state who have many bridges not capable of withstanding such loads; and it is also being opposed by certain counties in which the old-fashioned type of covered wood bridge as constructed 60 years ago is still in existence. The present legislation goes still further and aims to restrict the overall width of a motor truck to 88 inches. One interesting aspect of the present campaign is the fact that a traction engine company selling many traction engines in this state has circularized every county in the state asking that the voters go against the present $50,000,000 bond issue on the ground that traction engines with cleats on the wheels will not be permitted to use the improved highways. So strong was the influence against the bond issue in several counties because of this circularizing work that the bill was again returned to committee and a public hearing on it will take place this week.

Of the many bills against motorizing interests introduced many will never come out of committee. One or two desirable bills have been introduced. In this category is the Dunn bill providing that "All fees for licenses of motor vehicles collected shall, after deduction of collection expenses, be returned to the respective county where the licensee shall reside to be used in repairing and maintaining the roads of such county." Another bill provides that "All moneys derived from the registration of motor vehicles and the licensing of operators are to be paid into the treasury to be used in the improvement of roads." This bill further goes on to state "that the sum of $1,800,000 now in the treasury derived from the fees of registration be specifically appropriated for highways improvement and maintenance." Up to the present time Pennsylvania has not had a law permitting of the use of registration fees for highway improvement.

—

NEW YORK CITY, April 7—The automobile authorities of New Jersey are doing their best to inforce the 15-day limit for foreign cars entering the state. Two inspectors are stationed at the ferries which carry cars from Manhattan to New Jersey and other inspectors check incoming and outgoing out-of-state cars in other places. The inspectors meet regularly and by comparing their records determine what automobilists pass the 15-day limit for free travel in Jersey, so that their owners may be requested to take out Jersey licenses.

The state legislature has adjourned without taking any action of the various automobile measures proposed to it.

—

Motorists Fight Bay State Bills

BOSTON, MASS., April 5—Those who have been following the motor legislation and fighting the battles for automobile owners in the Bay State this year have had plenty work cut out for them, for there was a much larger number of bills presented than in past years.

The two most important matters have not yet been reported, the bill relative to trucks, limiting the weight and increasing the fees on them, and a bill to limit the speed of motor vehicles in the state.

The Highway Commission began the year by making a report to the Governor in which it went into the matter of legislation. This report stated that some some law should be passed for the preservation of the highways by limiting the speed and weight of motor trucks and prohibiting traction trailers that dug holes in the roadways. It also suggested that the same fee be charged for trucks as horse-drawn vehicles. Another suggestion was a law limiting the speed in this state to 25 miles an hour. It also suggested that the law be amended relative to operators from other states; that the law of the road be fixed, and the penalty for reckless driving be changed. Bills covering all these points were drawn by the commission and submitted. The bill relative to reckless driving is now a law, so that any person convicted of operating a car recklessly, without authority, for a wager or under the influence of liquor may be sentenced to jail for from 2 weeks to 2 years, and fined $200 for a first offense and for a second offense of driving while intoxicated the penalty is 1 to 2 years, no fine being allowed.

The bill to change the law of the road so that motor vehicles could pass street cars on the right-hand side—the Supreme Court having ruled it was unlawful to go other than on the left—was passed. Also the Commission's bill placing non-resident operators under the same regulations and laws as Bay State motorists got a favorable report and was passed.

This year there has been no bill to increase the passenger car fees, but there is a bill that would reduce them. It calls for $5 for 25 horsepower or under; $10 for 25 to 50 and $15 for all over 50. No report has been made by the committee on this yet, but it will probably be given leave to withdraw. Other bills on which the committee has not reported is one to strike out the 10-day clause for non-residents; a rebate bill to refund part of the money for registration if a veichle is lost, stolen, burned or sold before August 1, so that an owner loses the use of it; a bill put in by Mayor Fitzgerald to give back to the different counties the money taken in fines and which now goes to the State treasury for good roads, and the truck and speed bills reported above. It is expected that if the committee reports a speed law it will be one of 30 miles an hour, but any change will be fought by the motor interests, who are satisfied with the present law which calls for a reasonable speed.

The bills that have been reported upon make quite a representation when considered. One bill seeks to change the burden of proof from the government to the motorists in case of an accident by having the numbers of a car become prima facie evidence that the owner was responsible for whatever damage it caused. This bill was killed in other years, but this time it got to the Senate up to a third reading when the motorists woke up and sent a flood of letters to the State house that checked it.

A bill put in by the Highway Safety League requiring all motorists who figure in an accident to send a report of it to the Highway Commission was reported favorably, and is now in the lower branch of the legislature. The words "full report" were stricken out so that merely the notice of the accident is to be given. There is some doubt as to its being a constitutional measure. A bill that would require judges to place on file all complaints of motorists arrested for not having their licenses, if they proved in court that they were entitled to drive a car was reported leave to withdraw. The A. L. A. measure seeking permission to erect signs on the State highways met with the same report. So did the bill to increase the penalties to 20 years' imprisonment for anyone causing a death with a motor car. Mayor Fitzgerald's bill seeking to get a portion of the motor fees for the Boston Park System was dropped. A measure to prevent motor cars going within 15 feet of a street car that had stopped to take on or leave off passengers was also dropped. Another bill to compel motorists to stop within a few feet of a moving or standing car was dropped. The measure to change the age for licensing operators from 16 to 18 years of age got an unfavorable report.

From the point of view of many owners and makers the most important measures put in were two bills that would prevent cars being registered if it were possible to turn off the lights from any seat, either in front or in the tonneau, or the body of a limousine. This would mean the rearrangement of all cars electrically equipped. There were two hearings on these bills and the committee reported unfavorably on both. The bill to change the light law so that it would apply to vehicles in cities as well as those on the State highways as the law now reads was not reported favorably. The same fate was given the bill for a force of State Highway inspectors to check speeding. A bill that would prevent a man ever getting a license if he had once been convicted of operating under the influence of liquor was reported leave to withdraw.

S. A. E. on Worm Drive

Larger Bearings and Means of Adjustment Advocated at Detroit—Aluminum Alloys Also Discussed

DETROIT, MICH., April 4—The annual business session of the Detroit section of the Society of Automobile Engineers was held last night in connection with the regular monthly meeting. Officers for the ensuing year were elected as follows: Chairman, E. T. Birdsall; Vice Chairman, G. E. Cox; Secretary and Treasurer, H. A. Connell.

The report of the secretary and treasurer showed that at present the section has 147 members and that cash on hand in the bank totals $515.27, with no outstanding debts.

Following the business session technical matters were taken up. The first talk was given by Mr. R. T. Wingo, of the Superior Machine & Engineering Co., Detroit, Mich., and was a comparison of worm and bevel drive axles, which was characterized as being an exceedingly live subject just now. Mr. Wingo's remarks were confined chiefly to the shop end of the question of final drives. Many worm constructions have failed, due to several adverse conditions, and hence many engineers condemn them all. It is the same with the successful type. When one proves to be efficient many consider them all equally good.

Where Adjustment Is Needed

In the automobile vehicle many conditions govern worm and worm wheel drives, said Mr. Wingo. If the teeth are adjusted so as to be in correct relation to each other, they very often do not stay where they are placed. The fallacy is in making no provision for permanency of adjustment. It was advised that for best results adjustment should be provided for both members and for locking these after once properly set.

In the design of worms and worm wheels we are governed by conditions on either side of the assembly. In ordinary machinery the design is an easier matter, in that the speed can be governed more readily than in the motor vehicle.

Speaking of the mounting of the members on ball or roller bearings, Mr. Wingo advocated the use of larger sizes than those recommended by hiring salesmen. For taking both the radical load and end thrust it will be found that over-sized bearings are most satisfactory. This applies both to level drives and to worm gearing.

Workmanship is responsible for many worm-gearing failures, assuming that the designer has chosen the most efficient angles and ratios. The tooth forms must be smooth, free from scratches and absolutely true to form. If the surfaces are smooth and properly run in oil, the heat loss is reduced on account of less friction; hence, durability is augmented. This also applies to bevel gearing. Scratches and imperfections tend to breakage and noise and no amount of lapping in will cause them to wear smooth enough.

Methods of manufacture of various types of worm gearing were taken up and the best ways of cutting the members were pointed out. The Hindley and the Lanchester types were discussed and a third design also spoken of. This latter resembles the Hindley, but is really very much different in that the worm and worm wheel, as ordinarily considered, are reversed, the wheel in this case being the smaller member. This combination gives an oiling arrangement, which is said to be satisfactory.

Mr. Wingo is in doubt as to the best efficiency of the three types, but on numerous occasions has found it to be about 92 per cent. in the best cases. The rather remarkable figure of 99 per cent. has been reached by Mr. Wingo with specially constructed bevel gearings having ball thrusts. This, he stated, should be ordinarily nearer 97 per cent., while with machinery of the ordinary type it has been estimated at about 75 per cent.

In closing Mr. Wingo made the rather startling statement that the worm gearing must come for trucks, while for passenger cars it is on the decline, due to the greater perfection of bevel gearing and its less cost of manufacture for equal efficiency. The reason that it is essential to trucks is that these have a lower gear ratio and slower speeds, it being easier to properly proportion the parts and provide for lubrication for this slower running. The passenger car offers the disadvantage of too great average speed.

An open discussion on aluminum alloys for motor car construction was next staged, H. Goldberg, of the Aluminum Castings Co., speaking in favor of zinc alloys in preference to the No. 12 S. A. E. specification, which is a copper alloy. He stated that alloys up to 33 per cent. zinc are just as good as copper and they offer the advantage of cheapness and better machining. They have a higher tensile strength also.

Past zinc alloy failures were attributed to improper pouring temperatures, the alloy being more liable to crack when poured hot than when cold. Hot pouring means larger crystals, which are an evidence of weakness. Mr. Goldberg would like to see the automobile engineering fraternity get over its prejudice against this alloy, which unfavorable opinion was gained because it was not properly produced.

It was pointed out by one of the members that zinc has a strong adherence to oxygen and is, therefore, very easily oxydized, while copper is not nearly so prone to do so.

Several alloys which have been more or less successful were discussed and the advantages and disadvantages of each brought out. Mr. Goldberg stated that the best zinc alloy has the following specification: 19 per cent. zinc; 25 per cent. copper; 3.10 specific gravity; 30,000 pounds per square inch tensile strength.

The final discussion of the evening was that by E. J. Stoddard, member of the Nomenclature Division of the Society. He spoke of the very great importance which the skidding factor has on automobile construction. It was the consensus of opinion that skidding is a much bigger consideration than the average engineer believes. Mr. Stoddard's talk was short, and consisted mainly in the presentation of a problem which, he stated, has obsessed him for some time, relative to the apparently different rates of travel of the forward and rear ends of a motor vehicle in skidding around a curve.

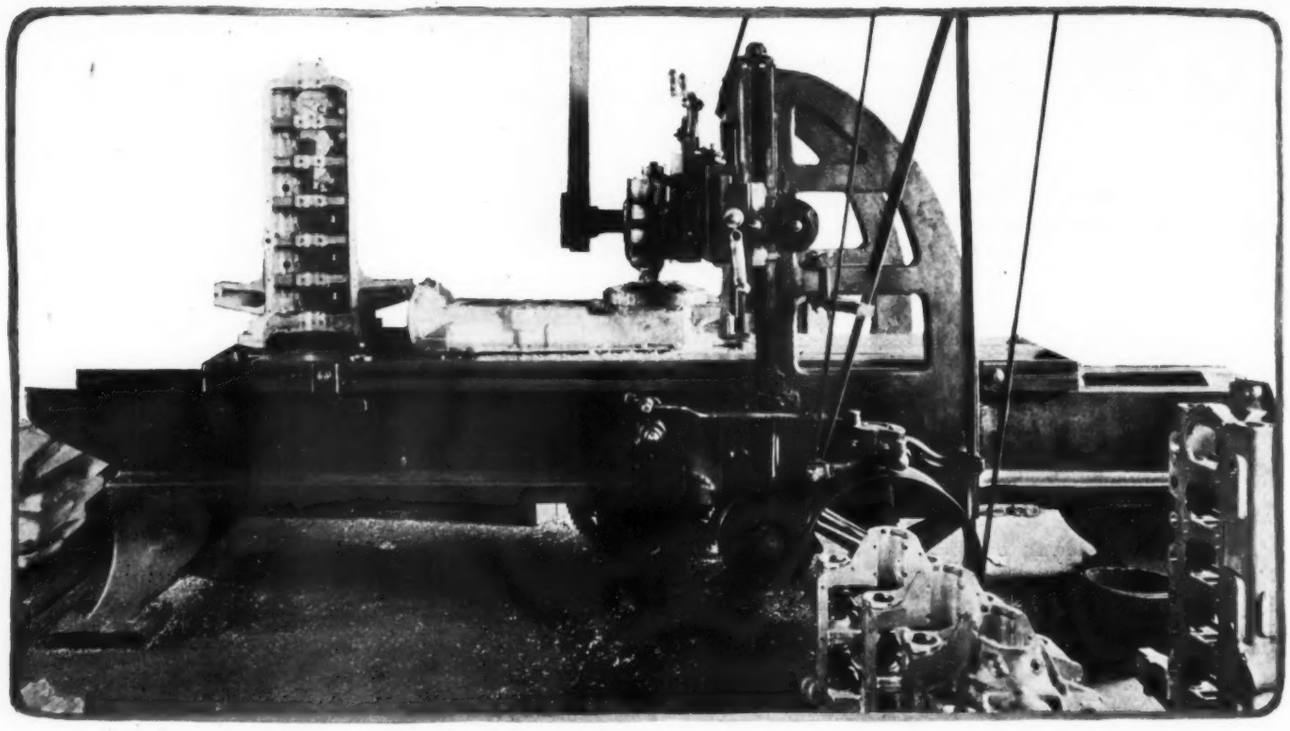
S. A. E. to Standardize Rim Sizes

NEW YORK CITY, April 7—In developing standard dimensions for rims the pleasure car wheel division of the standards committee of the Society of Automobile Engineers has not run against any difficulty which is not surmountable. At the meeting last Wednesday afternoon a report was read which stated that the variations in diameter and felloe width did not exceed .125 inch and .25 inch respectively, and that standard limits of toleration were possible. The work is now in the hands of the sub-committee on the ways and means of carrying on future tests which are necessary before definite action can be taken. This committee is expected to report at an early date.

About seventy-five tests have to be run and a good pressure line needed to make tests on various types of straight side and beaded tires in connection with the different forms of rims. These tests are apt to cost a large amount of time and to be expensive on account of the tubes and casings needed. The specimen rims are now all at the headquarters of the S. A. E. in this city and as soon as the sub-committee has reported the additional work will be taken up.

PHILADELPHIA, PA., April 7—A factory branch of the American Locomotive Co. has been established here, succeeding the Longstreth Motor Car Co., which has heretofore represented the Alco line of pleasure cars and motor trucks for Philadelphia and vicinity.

Factory Miscellany



Special machine used for milling crankcases in the factory of the Kline Motor Car Co., Richmond, Va.

THIS machine can mill twenty-five crankcases in one working day of ten hours. One crankcase is milled at a time and the machine is readily attended to by one man. The gain in factory efficiency so far as this particular branch of the milling work is concerned is 75 per cent over less modern methods of doing the same work. Every piece of work turned out by the machine is uniform and the maximum variation is well within the tolerance limit of .001 inch plus or minus. The accompanying illustration shows the machine at work on a Kline six-cylinder crankcase. This has seven bearings. The four-cylinder crankcases with five bearings are handled in the same manner. The same machine can be used for the five-bearing or the seven-bearing crankcases. The upright crankcase has been placed in this position for the purpose of showing the milling work necessary.

GARFORD Secures American Rights—W. F. Brown recently returned from London, England, bringing with him the American rights for the manufacture and control of some metals of which an alloy of aluminum is the most important. The new metal is called aeromin and is said to have twice the tensile strength of aluminum. The metal has been in use in England for several months and the American rights were secured for the Garford Engineering Co., Elyria, O. In the near future a meeting of the company's directors will be held and a location determined upon for the manufacture of the new product. Mr. Brown is president of the company, which is capitalized at $100,000, and it is believed that the plant will be located in Toledo, O.

Whitehall Wants Apparatus—Whitehall, Pa., is desirous of receiving bids for a motor-driven chemical apparatus.

Butler Tire Company's Salesrooms—The Butler County Tire Co., Hamilton, O., has opened salesrooms and a vulcanizing plant at 105 Main street.

Baker Sales Manager—L. M. Baker has been appointed sales manager for C. N. Peacock & Co., New York City, agent for the Ames shock absorber.

Promoting New Tire Company—W. F. Beasley of Plymouth, N. C., is promoting an organization of a company to manufacture emergency automobile tires, etc.

Bartholomew Sells Out—C. A. Bartholomew, who operated a garage in Peoria, Ill., has sold his business and removed to Knoxville, where he has opened a new garage. His old place in Peoria will be occupied by J. A. Vance & Son.

Cleveland Machine Builds—The Cleveland, O., Automobile Machine Co. will erect a factory addition at its present plant on East Sixty-fifth street. The building will be three stories high, 60 by 200 feet, and will be of the heavy factory type construction.

Trucks for Bell Telephone—Nine commercial cars for the American Bell Telephone Co. have been ordered by the Western Electric Co., from the Stewart Corp., of Buffalo, N. Y. It is probable that another order, for twenty more, will follow.

New Philadelphia Garage—Plans for a four-story-and-basement garage building, 58 by 90 feet and 116 by 90 feet, to be built at 2302 Chestnut street, at a cost of $20,000, were recently filed at that city. Kahn & Greenberg and Murray White are the owners.

Toledo Truck to Move—The Toledo Motor Truck Co., located on Spencer street, Toledo, O., is to be removed to Moose Jaw, Sask., in western Canada, according to the announcement of the owner, Edwin Tait. The machinery is now being packed for removal to the new quarters.

Tire Company Resumes Business—With repairs and enlargements completed, the Iron City & Repair Co., Pittsburgh, Pa., whose building was gutted by the fire started in the storeroom of the Pioneer Automobile Co. last winter, will resume business in the near future.

Automobile Plant to Reopen—More machinery has arrived at the Maxwell plant in Newcastle, Ind., from the Maxwell Motor Co.'s plants at Dayton, O., Tarrytown, N. Y., and Auburn, Ind. The force is being increased every day. A call has been issued for all the former employees of the die-sinking and screw-machine departments to send in applications for positions at once.

Mather Spring Doubles Capacity—The Mather Spring Co., Toledo, O., is planning to double the capacity of its plant.

Vulcan Purchases Plant—The Vulcan Mfg. Co., Painsville, O., has purchased an idle plant and will remodel it. The company will manufacture automobiles.

Secures New Site—The Automobile Mfg. & Engineering Co., Detroit, Mich., has acquired a factory site, comprising 108 acres, in Nashville, Tenn., where it expects actively to commence the production of the Evans truck. The plant will be 60 feet by 200 feet in size.

Another Safe Storm Addition—At the annual meeting of the Safe Storm Shield Co., Fremont, O., plans were adopted for erecting an addition to be 40 by 40 feet, two stories high, to the present plant, the addition being for storeroom purposes and a woodworking department.

Morgan & Marshall Build—With Mayor R. J. Marshall and Dr. Morgan Howell, of East Liverpool, O., as the chief moving spirits, the Morgan & Marshall Co-Operative Tire & Rubber Co., with a capital of $500,000, will soon begin the construction there of a factory for the manufacture of automobiles.

Expansion in Long Island City—Some of the automobile concerns already established in Long Island City, N. Y., are enlarging their plants, while others are building important structures. At the present time the automobile industry is spending more than $1,000,000 in increasing facilities in this section.

May Open Amplex Plant—The Lewis Motor and Engineering Co., Detroit, Mich., is about to take over the Amplex automobile plant in Mishawaka, Ind., and will again open the factory, according to reports. The plant was formerly operated by the Simplex Motor Car Co., composed by Mishawaka men, but has been closed for the last several months.

Rubber Company in Coshocton—The Cuyahoga Falls Rubber Co., of Cuyahoga Falls, O., has submitted a proposition to the Coshocton Board of Trade, Coshocton, O., to locate a plant of the proposed company, to be capitalized at $400,000, if free site were given this company and if the citizens would subscribe to a block of capital stock. The company will manufacture tires.

Pacific Factory Plans Progressing—Plans for the erection of an automobile factory in Seattle, Wash., on the property of the Seattle Car & Foundry Co., are rapidly assuming shape. The buildings necessary to the assembling of the cars are being remodeled and a testing track near the factory is being put in shape for testing the product. The car will be called the Pacific, and will be assembled from standard parts, including Hess axles, Warner gears, Wisconsin motors and Gemmer steering gear. It is to be offered in two models, both sixes.

Shows, Conventions, Etc.

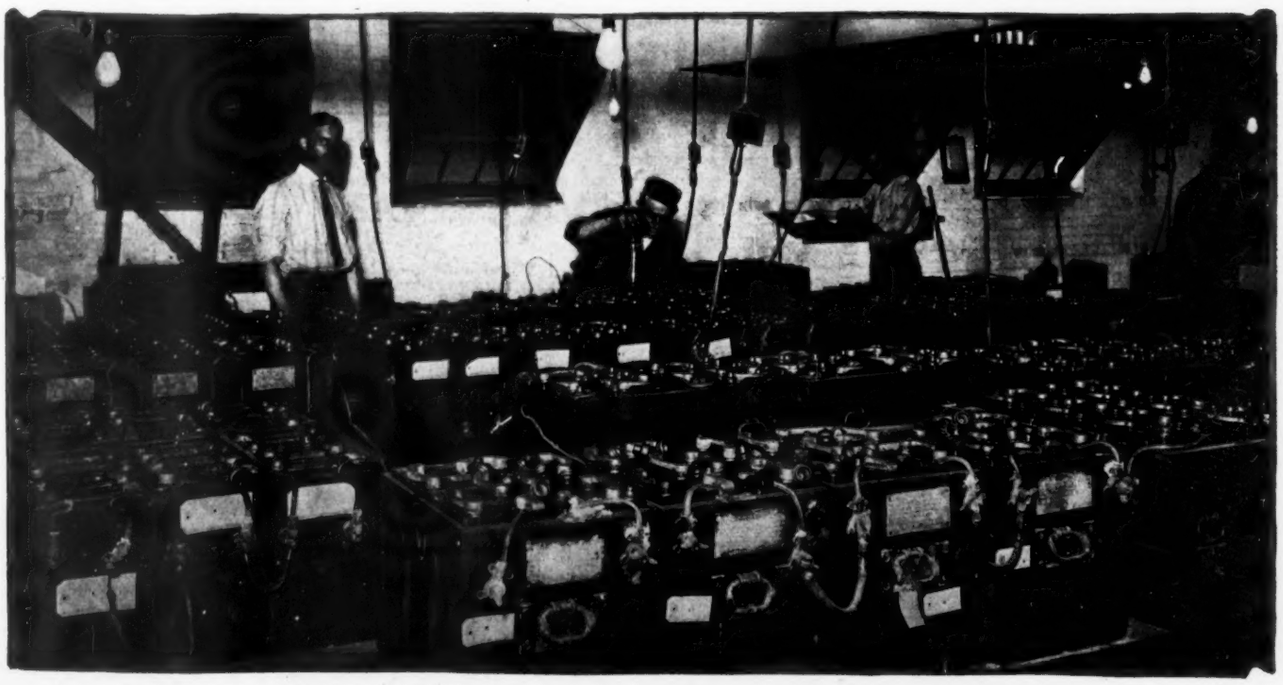
April 5-19.....Pittsburgh, Pa., Annual Show, East Liberty Market House, Dealers' Association.
April 21-26.....San Antonio, Tex., Annual Show, San Antonio Motor Car Show Co.
June 5, 6, 7.....Detroit, Mich., Midsummer Meeting of Society of Automobile Engineers.
October.....Paris, France, Automobile Show, Grand Palais; 10 days.
November.....London, Eng., Annual Automobile Exhibition, Olympia.

Race Meets, Runs, Hill Climbs, Etc.

April 27.....San Antonio, Tex., Track Meet, San Antonio Automobile Club.
April 28-30.....Chicago, Ill., Commercial Vehicle Demonstration, Chicago Motor Club.
May 2.....New York City, Secret Time Run to New Rochelle, Motor Dealers' Contest Association.
May 5-8.....Washington, D. C., Motor Truck Reliability, *Washington Post.*
May 14.....New York City, Start of 2-Day Hudson and Catskill Scenic Tour.
May 30.....Indianapolis, Ind., 500-Mile Race, Speedway.
June 7.....Philadelphia, Pa., Inter-Club Reliability, Quaker City Motor Club, Automobile Clubs of Delaware County, Philadelphia and Germantown.
June 25-28.....Chicago, Ill., Non-Motor-Stop Reliability, Chicago to Boston, Chicago Automobile Club.
July 1.....Indianapolis, Ind., Tour of Indiana Automobile Manufacturers' Association to the Pacific Coast.
July 1-16.....Winnipeg, Man., Motor Plow Competition, Dr. A. W. Bell, Manager.
July 4-5.....Sioux City, S. Dak., Track Meetings, Sioux City Automobile Club and Speedway Association.
July 5-6.....Tacoma, Wash., Road Race, Montemara Festa Automobile Committee.
July 8-16.....Winnipeg, Man., Midsummer Exhibition, A. C. Emmett, Manager.
July 27-28.....Tacoma, Wash., Tacoma Road Races.
Nov. 24.....Savannah, Ga., Vanderbilt Cup Race, Motor Cups Holding Company.
Nov. 27.....Savannah, Ga., Grand Prize Race. Automobile Club of America.

Foreign

April .....Barcelona, Spain, International Exhibition.
May .....St. Petersburg, Russia, International Automobile Exposition, Building of Michael Maneze, Imperial Automobile Club of Russia.
July 12.....Amiens, France, Grand Prix Race.
July 18-26.....London, Eng., Imperial Motor Transport Conference.
Sept. 25.....Isle of Man, International Stock Car Race.



Battery room in the factory of the Baker Motor Vehicle Co., Cleveland, O.

National test car crossing railroad bridge over the White Water River, South of Connersville, Ind. This car was the first out of Indianapolis into Dayton during the flood.

Two Premier test cars pulling a King road drag over Indiana roads injured by the recent flood

RECORD Contract—What is claimed to be a record contract was closed recently in Boston, Mass., by the R. & L. Co., agent for the Garford, whereby the L. & S. Co. of Providence, R. I., contracted for forty pleasure cars and twenty-two Garford trucks, the total amount represented being $209,850.

Kellam Ohio Electric Manager—J. Kellam has accepted a position as assistant sales manager with the Ohio Electric Car Co., Toledo, O.

Hartford Accessory Store Opened—The Automobile Owners' Supply Co. has opened an accessory store at 284 Trumbull street, Hartford, Conn.

LaFrance Contemplated Building Garage—The LaFrance Motor Car Co., Elmira, N. Y., it is reported, is considering the construction of a large garage near the central part of the city.

Motordrome in Milwaukee—A motordrome with a ¼-mile macadam track will be constructed in Milwaukee, Wis., this year by a company now being organized. The opening is set for July 4.

American Tire Branch Established—The American Tire & Rubber Co. has established a branch office and wholesale stock depot at 252 Fifth street, Milwaukee, Wis., in charge of Albert Weisskopf.

Schweers Purchases Frogner Garage—The Schweers Hardware Co., Shawano, Wis., has purchased the garage and business of the Frogner Auto Co., that city, and will continue it as a division of its business.

American Cars in Majority—Ninety per cent. of the automobiles used in Aguascalientes, Mexico, and in that vicinity are of American makes. Owing to the amount of quartz rock on the roads the life of tires is short.

Edwards with Midland Co.—C. C. Edwards has severed his connections with the Bergdoll Motor Co. branch at Boston, Mass., and will take charge of the Eastern territory for the Midland Motor Co., East Moline, Ill.

New Building for Cadillac—The Cadillac Automobile Co., Providence, R. I., recently signed a lease for 10 years for a new building that is being erected in that city. There will be three floors, all of which will be occupied by the company.

Amphibious Garage Planned—Harry L'Hommedieu, automobile dealer of Buffalo, N. Y., has purchased property in that city for the construction of what he terms an amphibious garage, which is to accommodate motor boats as well as automobiles.

Buys Another Garage—L. A. Vashon, proprietor of the Chestnut Hill garage, Brookline, Mass., recently purchased the Brandon garage in that same town and will conduct the two in future in addition to handling the Ford agency in that territory.

Now in New Building—J. T. Meagher, proprietor of the Mattapan, Mass., Motor Car Co., who has the Chalmers and Ford agencies in that town, has recently moved into a handsome new building 125 feet deep and 55 feet front on the main thoroughfare.

Jefferson Company Builds Garage—The Jefferson Auto Co. of Jefferson, Wis., has started construction work on a new concrete garage building on Main street. The size is 50 by 80 feet, but the building is so arranged that additional space may be taken at any time.

New Location Selected—The United Motors Co., Boston, Mass., the New England branch of the new Maxwell corporation, has moved from Massachusetts avenue and Newbury street to the building first occupied by the Locomobile Co. further along the latter street.

Velie Gets the Contract—The Velie Motor Car Co. of Boston, Mass., was the fortunate one to secure the contract for the runabouts to be used by the district chiefs of the Boston fire department. Seven runabouts will be ordered on the first contract and more may be secured later.

Feps, N. Y., Factory Branch—The Schoen-Jackson Co., manufacturer of the Feps carbureter, has opened a New York City factory branch office in the Thoroughfare Building, at 1777 Broadway. In addition to this the Schoen-Jackson Co., has established installation facilities at 107 West Fifty-first street.

Fenway Garage Opened—The Fenway Garage, the latest addition to Boston, Mass., which is being conducted by the Saunders & Butler Co., that does a taxicab service in that city, was recently opened. It is two stories high, fronting on the park system and adjoining the American League ball grounds. There are 100,000 square feet of space, and instead of elevators specially designed runways are used to move cars in and out of the building.

GRIPPER AND SIDE GUIDE

New Agencies Established During the Week

PLEASURE VEHICLES

Place	Car	Agent
Bar Harbor, Me.	Cadillac	O. H. & F. Jellerson.
Bar Harbor, Me.	Cartercar	Fred Sawyer.
Bar Harbor, Me.	Metz	Fred Sawyer.
Bar Harbor, Me.	Overland	W. H. Davis.
Bar Harbor, Me.	Studebaker	O. H. & F. Jellerson.
Bar Harbor, Me.	Velie	O. H. & F. Jellerson.
Bath, Me.	Cutting	Bath Garage Co.
Binghamton, N. Y.	Speedwell	W. D. Sweet M. C. Co.
Boston, Mass.	Cartercar	Hollander Motor Car Co.
Boston, Mass.	Maxwell	M-B-M Motor Co.
Boston, Mass.	Mercedes	Alfred Cutler Morse.
Boston, Mass.	Pathfinder	F. K. Patch.
Brookline, Mass.	Ford	L. A. Vashon.
Concord, N. H.	R-C-H	Concord Auto Sales Co.
Edgerton, Wis.	Imperial	F. P. Carrier.
Evansville, Wis.	Studebaker	The Durner Co.
Harrisburg, Pa.	Crawford	Bowman & Co.
Janesville, Wis.	Cartercar	J. H. Burns & Son.
Janesville, Wis.	Cutting	Janesville Motor Co.
Janesville, Wis.	Herreshoff	Janesville Motor Co.
Janesville, Wis.	Marathon	F. B. Burton.
Janesville, Wis.	Michigan	Park Hotel Garage.
Janesville, Wis.	National	Janesville Motor Co.
Janesville, Wis.	Overland	Janesville Motor Co.
Janesville, Wis.	Pathfinder	R. F. Buggs.
Janesville, Wis.	Rambler	Janesville Motor Co.
Janesville, Wis.	R-C-H	Goodman Livery Co.
Janesville, Wis.	Regal	R. F. Buggs.
Janesville, Wis.	Stutz	Janesville Motor Co.
Jefferson, Wis.	Ford	Jefferson Auto Co.
Kewashkum, Wis.	Studebaker	Remmel Mach. & Fdry. Co.
Lebanon, N. H.	Buick	Smith Auto Sales Co.
Lebanon, N. H.	Ford	Smith Auto Sales Co.
Lebanon, N. H.	KisselKar	Smith Auto Sales Co.
Lewiston, Me.	Chalmers	Androscoggin Motor Co.
Lewiston, Me.	Fiat	Androscoggin Motor Co.
Lewiston, Me.	Paige-Detroit	Androscoggin Motor Co.
Lewiston, Me.	Peerless	Androscoggin Motor Co.
Lewiston, Me.	Studebaker	Androscoggin Motor Co.
Manchester, N. H.	Overland	Smith-Ramsey Auto Co.
Plainville, Conn.	Michigan	F. O. Thompson.
Ridgeway, Ont.	Hupmobile	G. Weiss.
Ridgeway, Ont.	Oakland	G. Weiss.
Stevensville, Ont.	Hupmobile	G. Weiss.
Stevensville, Ont.	Oakland	G. Weiss.
Waterbury, Conn.	Ford	Jefferson Garage
Waterbury, Conn.	Overland	Jefferson Garage
West Cornwall, Conn.	Michigan	Edward Cartwright.
Worcester, Mass.	Havers	J. R. Hawks.

COMMERCIAL VEHICLES

Albany, N. Y.	Lippard-Stewart	W. S. Dodds.
Boston, Mass.	Blair	W. A. Magill.
Boston, Mass.	Jeffery	Thos. B. Jeffery Co.
Boston, Mass.	Lansden	Lansden Motor Co.
Boston, Mass.	Mercury	G. F. Kexhew.
Boston, Mass.	Vulcan	R. G. Howard.
Edgerton, Wis.	Dart	F. P. Carrier.
Hartford, Conn.	Autocar	Miner Garage Co.
Janesville, Wis.	Chase	J. A. Strimple Co.
Janesville, Wis.	Commerce	J. H. Burns & Son.
Janesville, Wis.	Jeffery	Janesville Motor Co.
Janesville, Wis.	Kissel	A. A. Russel & Co.
Janesville, Wis.	Service	Janesville Motor Co.
Minneapolis, Minn.	Dart	H. T. Heberels.

STEAM CARS

Janesville, Wis.	Stanley	Janesville Motor Co.
Worcester, Mass.	Stanley	Stanley Motor Car Co.

ELECTRIC VEHICLES

Boston, Mass.	Baker	F. N. Phelps.
Detroit, Mich.	Ohio	E. A. Rumsey.
Janesville, Wis.	Borland	Janesville Motor Co.
Janesville, Wis.	Detroit	Kemerer Garage.
Memphis, Tenn.	Ohio	Wright Motor Car Co.
St. Louis, Mo.	Ohio	Ohio Electric Sales Agency.

Cooley Prest-O-Lite Manager—S. M. Cooley has been appointed general manager of the Prest-O-Lite Co., Indianapolis, Ind.

Tudhope Moves Hamilton Branch—The Tudhope Motor Co. recently moved its Hamilton, Ont., branch from 280 King street East to 148 King street West.

Hamilton Wants Three Trucks—Hamilton, Ont., is in the market for three motor trucks for use in hauling gravel from nearby towns to that city for use in public works.

Lee Joins Motsinger Staff—Claude Lee has joined the Motsinger Devices Mfg. Co., Lafayete, Ind., and is said to be slated for the position of assistant general manager.

Copeland Sells Interests—W. A. Copeland, a Pontiac, Ill., garage owner, has sold his repair and garage business to John Hardie, of Streator, Ill. He will continue to handle the sales of Cadillac cars.

Albion Opens Toronto Station—The Albion Motor Car Co. of Canada recently opened a service station at 112 Richmond street West, Toronto, Ont., the building occupied by the Consolidated Motors, Ltd.

Building Work Planned—A garage will be built by Wendell & Wright, Philadelphia, Pa., on the south side of City avenue west of Lancaster avenue. The size will be 27 by 21 feet, two stories, and will cost $2,000.

DeSchaum Opens Own Office.—W. A. DeSchaum has opened engineering offices at 608 Wayne County Bank Building, Detroit, Mich. He has resigned as general manager and chief engineer of the Suburban Motor Car Co., that city.

North Tonawanda Wants Automobile—Police Chief J. F. Ryan of the North Tonawanda, N. Y., department renewed recently his application for an automobile for his department. The Common Council is considering the application.

Grand Trunk Installing Service—The Grand Trunk Railroad is considering the advisability of installing motor-car service between Buffalo, N. Y., and Bridgeburg, Ont., for Sunday travel. Definite decision will be announced shortly.

Sproul Increases Garage Capacity—Matt Sproul, who has the agency for the Buick and Maxwell cars in Sparta, Ill., has enlarged his garage facilities and installed a rebuilding and repair station for second-hand cars. He announces that he is in the market for equipment.

New Sales Plan—Martindale and Millikan, who are manufacturing the Continental at Franklin, Ind., have inaugurated a plan for selling cars on payments covering a period of one year. This company recently took over the property and business of the Indiana Motor & Mfg. Co.

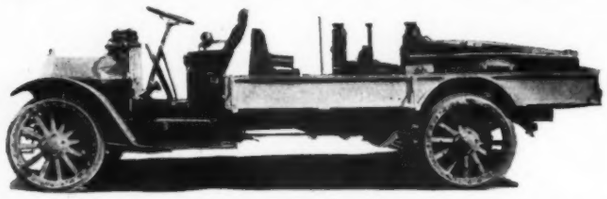
Multibestos Makers to Move—The Standard Woven Fabric Co., maker of Multibestos brake lining, is to move from Worcester to South Framingham, Mass., where larger quarters have been secured, a three-story concrete building having been erected there for the company that will be finished in a couple of months.

Automobile Deal in Newark—A large sale for automobile uses has been made in Newark, N. J. A piece of property on Central avenue near New street having a frontage of 56 feet on Central avenue and a depth of 245 feet with 96 feet in the rear. A four-story automobile building will be erected to cost $80,000. With the land the total cost will be about $125,000.

Bowman Leaves Schacht—F. P. Bowman has severed his connections with the Schacht Motor Car Co., Cincinnati, O. He will be connected with the Norwalk Motor Car Co., Martinsburg, W. Va., in the capacity of assistant sales manager with headquarters at Chicago, Ill. He will take care of the states of Ohio, Indiana, Illinois, Minnesota, Michigan, Iowa, Kentucky and Wisconsin.

Splitdorf Establishes Service Stations—The Splitdorf Electrical Co., Newark, N. J., will establish a European branch and service station at 6 City Road, Finsbury square, London, E. C. The company will also open a similar branch for the Southern territory of this country, with headquarters at Atlanta, Ga., within the next 60 days, and shortly after a branch for the Canadian trade, with headquarters in Toronto, Ont.

Kelly truck used in relief work at Dayton, O. The trucks loaned to the city by the various manufacturers were used in distributing food and in carrying away debris.



Upper—A 1908 Packard 30 equipped with a special squad body in the service of the Brooklyn Union Gas Co., Brooklyn, N. Y. Lower—Truck especially designed and built by the Federal Motor Truck Co. for the Detroit United Railway

Marvel Goes with Fiat—H. E. Marvel, who has been with the J. W. Bowman Co., has gone with the Fiat Sales Co., of Boston, Mass., and will handle that car.

Boston Republic Moves—The Republic Rubber Co., Boston, Mass., has removed to larger quarters at 863 Boylston street, where it has three floors at its disposal.

Fifteen Years Old—Last week brought the fifteenth anniversary of the sale of the first Winton automobile. On March 24, 1898, Alexander Winton closed the sale.

White Appointed Manager—E. W. White has been appointed manager for the sales branch of the Dupont Garage Co., Cleveland, O., agents for the Hudson line.

Manhattan Club Moves—On or about April 25 the Manhattan Automobile Club, Inc., New York City, will be lodged in new quarters in the Gainsborough Studios, 222 West 59th Street.

Rea Opens New Garage—West Philadelphia, Pa., has a new garage and repair shop which is called the Columbia Garage and is located at 421 North Fifty-fourth street. It is the property of A. D. Rea & Co.

Fire Loss at San Antonio—Fire which broke out in the service station of the Staacke Bros. Automobile Co., San Antonio, Tex., destroyed the building and consumed twelve automobiles, causing an estimated loss of $30,000.

Novel Office Organization—More than 100 department heads and employees of the Studebaker Corp.'s automobile division in Detroit, Mich., have banded into a Studebaker club for the purpose of becoming more familiar with each other's work.

Houpt with Elevator Company—H. S. Houpt, who recently resigned as sales manager of the Alco car, was recently elected vice-president of the Gurney Elevator Co. He will have charge of the sales and installations and will have his office in New York City.

New Kissell Service Station—The KisselKar Motor Co., Chicago, Ill., has opened a new service station in that city at Wabash avenue and Twenty-sixth street. This building contains 70,000 square feet of floor space and is three stories high and occupies a site 120 feet by 192 feet.

Two Cars for St. Louis Line—Official notice of the motor car service between St. Louis, Alton and Chautauqua on the C., P. & St. L. Railroad has been given out to the effect that two cars will be put in service, one between Alton and Chautauqua and the other between St. Louis, Mo., and Springfield, Ill.

Swinehart Opens Buffalo Agency—The Swinehart Tire & Rubber Co., Akron, O., recently opened an agency in Buffalo, N. Y., at 726 Main street. It will be under the management of E. F. Howell and C. A. Couch. This agency will act as a distributor in western New York and northwestern Pennsylvania.

By Way of Correction—In the issue of March 27 of THE AUTOMOBILE, under the heading of Communications from Makers, the letter appearing under P. P. Dean's name formed part of a talk that he presented before an automobile school on engine testing apparatus in general and did not form part of a communication from his company.

Organize New Lamp Concern—H. J. Johnson, W. C. Montie and J. L. Ballash have organized the Cleveland, O., Motor Lamp & Radiator Co., as successors to the repair department of the Guide Motor Lamp Co., which concern is now centering its efforts along manufacturing lines exclusively. The new company has leased the former quarters of the Guide company on the fourth floor of the Graves Building, 2069 East Fourth street,

Bosch Offers Winners $1,000—The Bosch Magneto Co., New York City, will make the following prize distribution to the winners of the 500-mile International sweepstakes to be held at Indianapolis, Ind., on May 30: To the winning driver, $500; second man, $300, and the third man $200. The condition attached to each award is that the driver of the car gaining first, second or third position must employ a Bosch magneto for ignition purposes during the race.

Belgian Bodymaker Visits States—Willy Van den Plas, the Belgian body builder, well known as the creator of the Mettalurgique body styles, has arrived in New York City. Mr. Van den Plas contemplates the creation of an American branch which is to supply the makers and owners of automobiles with special body designs. After having spent a few days in New York Mr. Van den Plas will go to the large manufacturing centers of the West in order to feel the pulse of the industry and if possible establish relations with the car makers.

Bosch Appointments—The Bosch Magneto Co., New York City, has appointed the following concerns to act as supply stations and to be of help to the users of its products: The Lemke Electric Co., Milwaukee, Wis.; Miller-Dudley Co., Washington, D. C.; Beverly Garage, Staunton, Va.; Virginia Motor Car Co., Petersburg, Va.; Dan Valley Motor Co., Danville, Va.; Fairchild Auto Co., New Orleans, La.; Ozburn Auto Supply Co., Memphis, Tenn.; Drennan Motor Car Co., Birmingham, Ala.; Chester Motor Car Co., Nashville, Tenn.; Hobbie Motor Car Co., Montgomery, Ala.; Mobile Auto Co., Mobile, Ala.,; Woodside Motor Co., Charlotte, N. C.; American Ball Co., Providence, R. I., and the Bakersfield Garage & Auto Supply Co., Bakersfield, Cal.

Automobile Incorporations

AUTOMOBILES AND PARTS

BRONX, N. Y.—North End Coach & Auto Co.; capital, $2,000; to deal in automobiles. Incorporators: A. A. Bertini, Seymour Mork.

BROOKSBURG, N. Y.—A. R. Newcombe; capital, $5,000; to deal in automobiles. Incorporators: A. R. Newcombe, Luella P. Newcombe, M. W. Newcombe.

CHATTANOOGA, TENN.—Hirsch Motor Car Co.; capital, $5,000; to deal in automobiles.

DETROIT, MICH.—Gilmore Motor Mfg. Co.; capital, $35,000; to manufacture motors. Incorporators: George Gilmore, M. A. Shaw.

DOVER, DEL.—Motor Car Sales Co.; capital, $25,000; to deal in automobiles. Incorporators: Newton Gies, G. M. Emory, C. C. Frederick.

GRAND RAPIDS, MICH.—Michigan Hearse & Automobile Co.; capital, $600,000; to manufacture automobile hearses.

LYNN, MASS.—Atlantic Auto Co.; capital, $10,000; to deal in automobiles. Incorporators: C. J. Goldman, W .A. Bishop.

MACON, GA.—Macon Auto Co.; capital, $6,000; to deal in automobiles. Incorporators: C. F. Calhoun, J. P. Stubbs, F. T. Abel, W. E. Henry.

NEWARK, N. J.—Smith Motor Car Co.; capital $25,000; to deal in automobiles. Incorporators: J. L. Smith, L. W. Smith, J. W. Mason.

NEW YORK CITY.—Motor Coach Co.; capital, $500,000; to manufacture automobiles and motor car hearses. Incorporators: Sam Richenthal, Elbert R. Benyunes, Herman Miller.

PINEVILLE, KY.—Cumberland Motor Co.; capital, $50,000; to deal in automobiles. Incorporators: N. J. Weller, A. W. Bryant, M. J. Moss, J. A. Pitman.

RALEIGH, N. C.—Citizens' Motor Co.; capital, $25,000; to deal in automobiles. Incorporators: W. D. Adams, G. C. Glenn.

SACRAMENTO, CAL.—Golden West Motors Co.; to manufacture automobile engines. Incorporators: W. H. Williams, I. Williams, K. M. Robinson, H. Breniser, G. Breniser.

SCHENECTADY, N. Y.—Schenectady Autocar Co.,; capital, $10,000; to deal in automobile buses. Incorporators: Emmett Fisher, A. Langeneuer, L. Buonfigils.

GARAGES AND ACCESSORIES

BOLIVAR, N. Y.—Star and Crescent Oil Co.; capital, $18,000; to deal in automobile oils. Incorporators: J. A. Wilber, R. B. Moore, C. M. Van Buren.

CAMDEN, DEL.—Easy Starter & Speeder Co.; capital, $25,000; to manufacture and sell starting devices. Incorporators: F. R. Hansall, G. H. R. Martin, S. C. Seymour.

DETROIT, MICH.—Crescent Co.; capital, $200,000; to manufacture starting devices. Incorporators: H. H. Potter, F. W. Owen.

DETROIT, MICH.—Tire & Auto Service Co.; capital, $10,000; to operate a garage. Incorporators: R. C. Wanto, W. H. Bishop.

GRAND RAPIDS, MICH.—Auto Tire & Vulcanizing Co.; capital, $3,000; to repair tires.

Babcock Firestone Advertising Manager—E. S. Babcock has been appointed advertising manager of the Firestone Tire & Rubber Co., Akron, O.

Seattle Reo Moves—F. A. Mitchell & Co., Seattle, Wash., distributors for Reo cars have recently moved into new and larger quarters at 1010 East Pike street.

Fall Tire Distributors—Naegee & Lamb have been made northwestern distributors for the Fall tire in the Dakotas and Minnesota with offices in Minneapois, Minn.

Tremme Manager—Arthur Tremme, formerly with Chancler & Lyon, Seattle, Wash., has become manager for John Millen & Son at Vancouver and Victoria. B. C.

Moon Agency in New Home—The J. D. Perry Lewis Automobile Co., St. Louis, Mo., agent for the Moon car, is in its new quarters on Walton and Washington avenues.

Entz Opens Office—The T. B. Entz Automobile and Battery Co., St. Louis, Mo., has opened a downtown office in that city, where it will make a specialty of caring for electric cars.

Columbia in New N. Y. Quarters—The United Motor New York Co. is now settled in its new and larger quarters at 1932 Broadway, New York City. R. L. De Lisser is manager of the company.

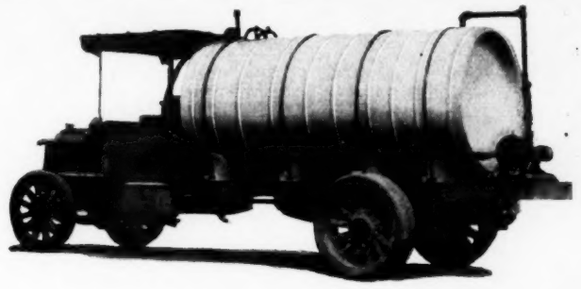
Metz Opens Factory Branch—The Metz Co., Waltham, Mass., recently opened a factory branch in Los Angeles, Cal., at 1821 San Pedro street. A. C. Lown is in charge of the service station.

Opens Magneto Station—C. L. Dobbs has opened the Twin City Magneto Exchange, Twin Cities, Minn., at 1018 Nicollet avenue and will test, repair and install electric ignition and starting systems.

Automobile Agencies Combine—The Keystone Auto Co. has taken over the interests of the United Motor Pittsburgh Pa., Co., and in the future the firm will be operated as the Keystone Auto Co.

Whitman Changes—D. E. Whitman, for some time past with J. W. Leavitt & Co., in Los Angeles, Cal., has recently been placed in charge of the Apperson department of the Reo-Pacific Co., that city.

Curt Now Sole Owner—Joseph Curt, Jr., is now the sole owner of the Anthracite Motor Car Co., Scranton, Pa., with offices and salesrooms at 625 Lackawanna avenue. This company handles the Overland car.



Upper—Packard 3-ton truck chassis equipped with a tank body, used by the Brooklyn Union Gas Co., Brooklyn, N. Y., to pump water out of gas lines

Lower—A 5-ton Peerless vinegar truck with an ingenious quick-loading device, which is operated by Alarth & McGuire, of New York City

Automobile Incorporations

HUNTINGTON, W. VA.—Fourth Avenue Garage Co.; capital, $10,000; to do a general garage business. Incorporators: C. L. Hamilton, C. I. Leftwich, J. M. Stark.

NEW YORK CITY.—Normal Automobile Station; capital, $10,000; to conduct an automobile garage. Incorporators: J. F. Bokelman, A. Bokelman, Edward Ganter, John Ganter.

NEW YORK CITY.—Herschel Tire and Rubber Co.; capital, $10,000; to deal in automobile tires. Incorporators: R. Henschel, Anna Henschel, W. A. Wollman.

NEW YORK CITY.—Approved Auto Specialties Co.; capital, $10,000; to deal in automobile accessories. Incorporators: J. B. Brandreth, K. D. Brandreth, E. C. Phelps.

NEW YORK CITY.—Mercer Rubber Co.; capital, $10,000; to manufacture and deal in rubber goods. Incorporators: W. A. Dale, J. C. Dale, W. H. Saijer.

NEW YORK CITY.—Peerless Tire Co.; capital, $15,000; to deal in tires. Incorporators: Michael Schiavone, G. P. Calenda, Louis Schiavone.

NEW YORK CITY.—Ireland Rubber Co.; capital, $25,000; to deal in automobile tires. Incorporators: F. W. Humphreys, Charles Summa, Walter Elrich.

NEW YORK CITY.—G. C. Vaporizer Co.; capital, $50,000; to manufacture vaporizers and carburetors. Incorporators: George Richards, D. W. Richards, Frank Sowers.

NEW YORK CITY.—Seeing New York Automobiles; capital, $10,000; to operate sight-seeing automobiles. Incorporators: G. H. Milligan, Thomas Frost, J. V. Fallon.

ROMEY, W. VA.—Hampshire Garage; capital, $5,000; to carry on a general garage business. Incorporators: J. J. Cornwell, E. V. Parker, D. E. Pugh.

SAVANNAH, GA.—Savell Rubber Tire Co.; capital, $25,000; to manufacture automobile tires. Incorporators: W. B. Savell, W. W. Horndell, Charles Savell.

ST. JOHNS, MICH.—T. C. Beach Auto Turntable Co.; capital, $10,000; to manufacture an automobile turntable for use in garages. Incorporators: T. C. Beach, R. S. Clark, W. J. Moss, R. H. Chapin.

ST. LOUIS, MO.—St. Louis Rubber Mfg. Co.; capital, $10,000; to manufacture automobile tires. Incorporators: J. A. Mulherin, G. P. Dougherty, Paul F. Mulherin.

SUFFOLK, VA.—Suffolk Garage and Machine Co.; capital, $15,000; to do a general garage business. Incorporators: C. C. Parker, G. L. Bower.

WASHINGTON, D. C.—Imperial Motor Tire Co.; capital, $100,000; to deal in automobile tires. Incorporators: F. D. Geraghty, E. A. Garlock, M. T. Wiggins.

CHANGES OF NAME AND CAPITAL

DETROIT, MICH.—Motor Foundry Co.; increase of capital from $35,000 to $100,000.

MEMPHIS, TENN.—Blomberg Automobile Co.; increase of capital to $30,000.

WABASH, IND.—Service Motor Car Co.; capital increase to $250,000.

General Motors Builds Garage—The General Motors Truck Co., St. Louis, Mo., the Missouri corporation of the General Motor Co., Detroit, Mich., has taken out permits to build a large garage and repair plant in that city.

Parker Anderson Manager—E. Reese Parker, formerly manager at Philadelphia, Pa., and elsewhere for the Anderson Electric Car Co., Detroit, Mich., has been made manager at Minneapolis, Minn., to succeed W. R. Jenney.

Murray Transferred—E. C. Murray, manager of the Minneapolis, Minn., branch of S. F. Bowser & Co., has been transferred to the combined headquarters at Chicago, Ill., but will continue to supervise the Minneapolis service station.

Another New Garage—Another new garage will be built in Ridgway, Pa., in the near future. The building will be 50 by 160 feet, of brick construction and probably two stories high. Mr. Curry will lease the building for a period of 10 years. He will repair automobiles.

Plans Thirteen-Story Garage—Plans have been filed with the city building department, New York City, for an eleven-story garage building 100 by 118 feet on Sixty-first street near Columbus avenue. A. Penchot, 60 Broadway, is owner. The building will cost $325,000.

Bennett with Standard Roller Bearing—R. M. Bennett, who until recently has been in charge of the automobile department of the Jones Speedometer Co., New Rochelle, N. Y., has accepted a similar position with the Standard Roller Bearing Co., Philadelphia, Pa.

New Truck Company Formed—A new company, called the Henry Tobin Co., Inc., has been formed to market motor trucks of all kinds. A. H. Chadbourne has been appointed sales manager. The company has leased the building located at 50 West Fifty-ninth street, New York City.

Hupmobile's Hamburg Parts Depot—The Hupp Motor Car Co., Detroit, Mich., has established a parts depot at Hamburg, Germany. Mr. George Chailley will manage the plant. The depot will carry a complete stock of parts of every Hupmobile ever built and will supply stock on a moment's notice.

Edison's Electric Car Garage—Following an address by Mr. W. C. Anderson, president of the Anderson Electric Car Co., Detroit, Mich., to a meeting of the New York Edison Co.'s managers, a special appropriation of $30,000 was voted for the purpose of establishing an exclusive electric car garage in New York City.

Patents Gone to Issue

AUTOMOBILE CARBURETER—In which throttle needle valve and auxiliary air valve are operated by connections so linked as to be simultaneous in their action on the parts mentioned.

Fig. 1 illustrates the carbureter described in this patent, which includes a vertical tubular mixing chamber M, a float feed F, a throttle valve T between M and the outlet connected to the cylinder and a rotary auxiliary air valve A which is arranged below the mixing chamber M on an axis longitudinally to and within M. A needle valve N for regulating the flow of fuel from the float chamber to the mixing chamber is arranged between A and T at an acute angle to the axes of these valves. Connections Ct, Ca and Cn—corresponding to the three valves—operate the latter simultaneously and conjointly, being provided with means for varying the relative throw of each valve. The connections consist of cranks on the valve stems having a number of holes and two connecting rods with ends adjustable in these holes to or from the centers of the cranks.

No. 1,0578,506—to Elbridge W. Stevens, Baltimore, Md. Granted April 1, 1913; filed June 2, 1910.

Automobile Wheel—Including dash pot spokes.

The wheel Fig. 5 includes a hub H, spoke cylinders S connected with it and containing a fluid rim, a rim R and pistons P connected with it and reciprocating in the cylinders. Each piston includes a head J for dividing the cylinder S into separate chambers and is provided with a valve controlled passage Q connecting the chambers formed in S. The piston is formed with a constantly open passage O of restricted cross area which connects the chambers formed in S.

No. 1,057,907—to Levi B. Wilson, Philadelphia, Pa. Granted April 1, 1913; filed August 5, 1911.

Internal Combustion Motor Valve—Including a piston valve driven by a half-time shaft geared to the crankshaft of the motor.

The subject matter of this patent is an internal combustion motor, Fig. 2 operating on the four-stroke cycle. The design described in this patent includes, in combination with a crankshaft S and a cylinder C, a piston valve V which is adapted to be reciprocated inside of a cylinder communicating with C, for the purpose of regulating the admission and exhaust of gas to and from the cylinder C. A valve rod R is connected to the valve while its other end is connected to a member M so mounted and driven by gearing from the crankshaft of the engine, that the axis of the member connected to the bottom of the valve rod describes, during one complete cycle of the engine a three-lobe hypocycloidal path of movement.

No. 1,057,399—to Daniel Appel, East Cleveland, O. Granted April 1, 1913; filed March 31, 1912.

Automobile Tire—Consisting of elastic cushions secured in place on a rim by flanges fastened to it by means of keys fitting transverse rims.

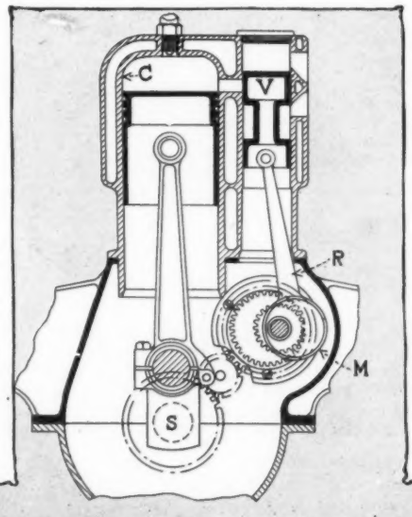
This patent refers to an automobile tire design as that shown in Fig. 3. In this tire the rim R is formed with transverse ribs Q each of which is provided with a keyway K on each side. Elastic cushions C formed with lateral flanges are in position between the ribs. Treads T formed with similar flanges fit over into individual cushions and are formed with keys adapted to engage the transverse ribs on both sides. Means M for preventing the accidental displacement of the key are provided, consisting of teeth and engaging notches on the sides of the key and the adjacent tread flanges.

No. 1,057,672—to Jacob Ruppert, Jr., and Ernest Siegel, New York City. Granted April 1, 1913; filed March 5, 1912.

Pneumatic Tire Design—Including separate inflatable compartments.

The tire described in this patent is illustrated in Fig. 4, and consists principally of a number of inflatable compartments made of rubber or a similarly elastic material, and being permanently connected at their ends and arranged in a sheath S. An air tube communicates with all the individual compartments C and the air for inflating the latter is supplied to the tube through an inflating valve V carried by it. Means are provided for cutting off communication between the tube and compartments C.

No. 1,057,580—to Elbert Charles Rhodes, Chicago, Ill. Granted April 1, 1913; filed February 16, 1911.



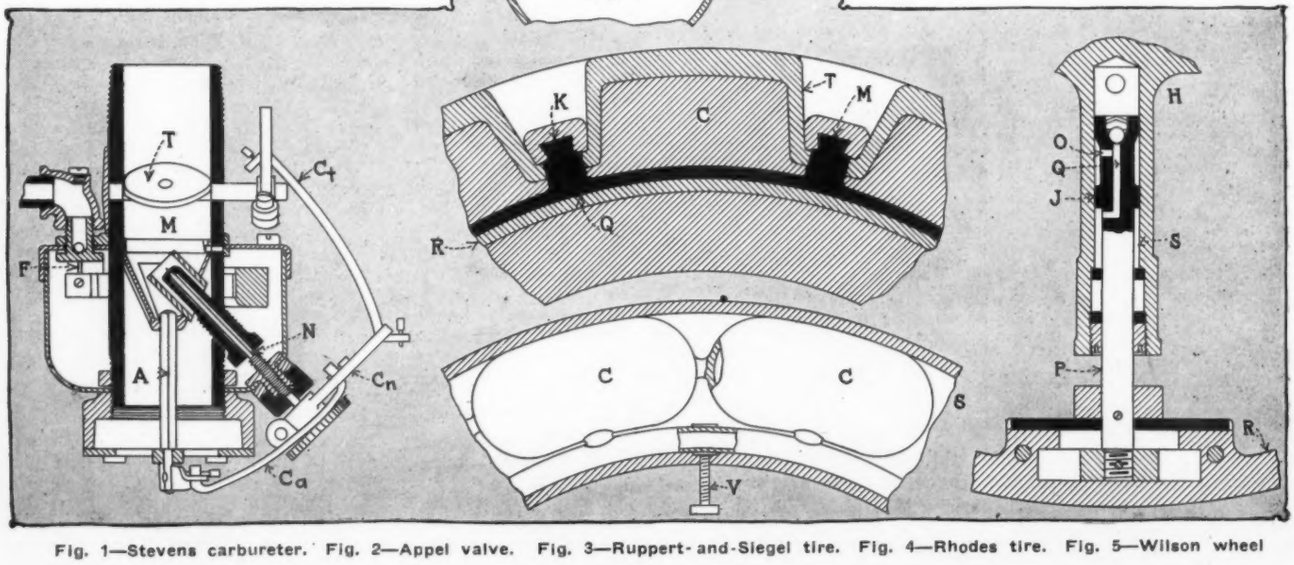


Fig. 1—Stevens carbureter. Fig. 2—Appel valve. Fig. 3—Ruppert-and-Siegel tire. Fig. 4—Rhodes tire. Fig. 5—Wilson wheel